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BANCO INVEST CONSULTING PROJECT

CREDIT RISK

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List of Abbreviations

S.A.	Sociedade anónima
SGPS	Sociedade gestora de participações sociais
S&P	Standard & Poor's
CPGP	Competitive Position Group Profile
EBITDA	Earnings before interest, tax, depreciation and amortization
FFO	Funds from operations
RCF	Retained cash flow
FCF	Free cash flow
CFO	Cash flow from operations
COGS	Cost of goods sold
Capex	Capital expenditures
CCC	Cash conversion cycle
CAI	Capital and asset-intensive
SBP	Services and branded products
NI&U	National industries and utilities
PD	Probability of default
CRA	Credit Rating Agency
e.g.	for example

Introduction

The topic of our master thesis work project is the field lab centring around credit risk in cooperation with Banco Invest. Banco Invest is a Lisbon-based investment bank which offers corporate finance solutions in the areas of mergers, acquisitions and restructuring and operates in the fields of asset management, brokerage and property leasing. It was founded in 1997 as Banco Alves Ribeiro S.A. and was renamed Banco Invest in 2005. It is a subsidiary of Alves Ribeiro Investimentos Financeiros, SGPS S.A.

The main goal of our field lab project was to develop a credit scoring model for large and medium-sized corporate clients of Banco Invest as well as to improve the current rating system and add methodologies which allow for measuring probabilities of default.

Our work project builds upon two pillars: first of all, we analyse the credit risk tool of Banco Invest, critically discuss its benefits and shortfalls and subsequently present our own rating model. Secondly, we turn to academic research on the assessment of probabilities of default and apply two models, namely the Altman Z-score model and a logit regression model to the Banco Invest company portfolio. We compare the scores obtained through application of the two approaches and close the analysis by drawing conclusions from the outcomes we obtain.

In addition to this report, we have created an Excel tool which is based on our credit model and able to return a credit score, Z-score and probability of default for every company of the Banco Invest set. We did so in order to provide the Bank with a solution that it could possibly apply in its daily business routine and to comply with the practical, consultancy-style approach of our work project.

Before evolving with the analysis of the two pillars previously mentioned, we would first like to start by giving a brief, general outline on the topic of credit risk.

One of the most crucial considerations in finance is the relationship between risk and return. Any investment that yields a rate of return beyond the risk-free rate will embody a certain type and degree of risk which an investor consequently gets compensated for.

While for equities, risk is of systematic nature and consists in possible movements of the overall market which trigger price declines on the single-stock level, risk in fixed income markets comes in different notions. Investors putting their money in loan or bond securities face e.g. interest rate risk meaning that their portfolio's value will fluctuate according to the term structure of interest rates. Moreover, they encounter inflation risk since inflation will dilute the return they earn on their investments in real terms. Ultimately, and most decisively for our master thesis project, fixed income investors are confronted with credit risk which raises to the potential that a debtor is not able to fulfil his debt payments as stated in the contractual documents of the security.

Hence, knowledge about and proper assessment of credit risk appears to be crucial for an investor to efficiently allocate the funds he has at hand. This is essentially where credit ratings come into play. Credit ratings pose an analysis of the solvency of a debtor who can be an individual, a corporation, an institution or a state issuing a debt security. Credit ratings represent a tool that facilitates decision-making to investors of which debtor to concede credit to and implicitly reveal an assessment of the debtor's likelihood to default. On the debtor side, credit ratings determine the spread to be paid for loans and bonds and hence form an essential part of the overall cost of capital. Credit ratings thus are crucial for debt markets since they facilitate the matching of supply and demand for funds by allowing for a better valuation of the risk-return profile of each investment.

While there are three big rating agencies - Standard & Poor's, Moody's and Fitch - who publish ratings on major corporates, institutions and states, investors (particularly banks) may run their

own internal credit rating analysis tools to evaluate debtors that are not covered by agencies. Banco Invest's credit risk model falls under this category.

During the course of our thesis project, we recognized that credit risk analysis is neither solely science nor art but rather a conjunction of both. It entails financial, accounting and statistical elements but it is also influenced by subjectivity in the assumptions drawn. It spans multiple dimensions ranging from macroeconomic considerations to in-depth analyses of the financial statements of a company. Eventually, the challenge is then to convert all the information one obtains into a comprehensive model comprising metrics that are well measurable and comparable between firms, a matter which we will try to accomplish in the following course of the report.

I

Banco Invest Internal Credit Rating Model

Before unfolding with our own suggestion for a possible credit rating model, we would first like to give an overview of the internal credit risk tool that the bank is currently using.

Banco Invest Rating Model		
Rating Factors	**Sub-Factors**	**Weighting**
Scale		**5%**
	Revenues	*5%*
Business Profile		**35%**
	Market Characteristics	*5%*
	Expected Growth	*5%*
	Competitive Profile	*5%*
	Technology Position	*5%*
	Geographic Diversification	*5%*
	Exogenous Factors	*5%*
	Market Share	*5%*
Financial Profile		**45%**
	Net Debt / EBITDA	*15%*
	EBITDA / Interest Expense	*15%*
	RCF / Net Debt	*10%*
	(FFO - Capex) / Debt	*5%*
Financial Policy		**15%**
	Shareholders	*5%*
	Governance	*5%*
	Financial Policy	*5%*

Banco Invest's model contains of four different factors, two being of quantitative and two of qualitative nature. Namely, there are the factors of "Scale", "Business Profile", "Solvency and Financial Coverage" and "Financial Policy". Three of the four sectors are further on divided into sub-factors, only "Scale" is a stand-alone category. Each (sub-)factor gets assigned a weight according to which its respective rating will influence the overall company rating. The

company rating itself is then the weighted average of all the individual, factor-based ratings. The ratings themselves are assigned through a specific scoring table per sub-factor.

According to Banco Invest's definition, the "Scale"-factor should depict *"the general access to resources and improvements due to internal organization as well as cost advantages that are linked to economies of scale. The larger the enterprise in terms of NPV, the larger its ability to capture this advantage".* More concretely, "Scale" rates the volume of revenue a company can generate in absolute terms *(Appendix 1).* On a 10-step scale, it assigns an Aaa rating for companies with more than €3.000 million in revenue going down to a default rating for companies with less than €50 million in revenue. "Scale" has a weight of 5% in the overall rating calculation.

The second quantitative factor, "Solvency and Financial Coverage" captures different financial ratios, all being indicative of the entity's ability to carry out its debt payments in due time. In more detail, Banco Invest applies the following four ratios:

- Net Debt / EBITDA (leverage ratio)
- EBITDA / Interest payable (coverage ratio)
- Retained Cash Flow / Net Debt (cash flow coverage ratio)
- (FFO - Capex) / Debt (cash flow coverage ratio)

Here again, Banco Invest assigns a rating to each one of the four sub-factors in relation to the level of the ratios obtained *(Appendix 2)*. "Solvency and Financial Coverage" counts with a weight of 45% in the computation of the holistic company credit rating, of which 15% are allocated to the first and second ratio, 10% to the third ratio and 5% to the fourth ratio.

Moving towards to the qualitative factors of Banco Invest tool, we have to contemplate "Business Profile" and "Financial Policy".

"Business Profile" is subdivided into seven different sub-factors, which match to the following definitions by Banco Invest:

- Market demand characteristics: *"Characterizes the impact of global demand characteristics in the markets the company deals in. A company operating in a structurally declining market will face more difficulties in maintaining its cash-flow generating capacity on the long-run, even if it is the best in its sector".*
- Company growth potential: *"Assesses the company's growth profile in its various P/S, considering that a fast-growing company will present better conditions for timely repayment of its debt".*
- Competitive Profile: *"Analyses whether a company is dependent 1) on only one business segment or 2) on the negotiating power of customers. The more diversified a company's product offering and client base, the greater its resistance to cycles of economic contraction".*
- Technological Positioning: *"Technological evolution affects all sectors and economic activities. Hence, the business model of the company is assessed assuming that it is subject to this technological change. Faster technological evolution within the sector in which the company is operating also normally requires higher investments which may affect the company's ability of debt repayment and shareholder remuneration".*
- Geographic and business diversification: *"Geographic diversification across unrelated markets tends to improve the company's competitive position given its stabilizing effect amid different business cycles. However, diversification into emerging markets (usually more profitable but also more volatile and extreme) may affect the rating negatively if it requires significant investments or increases the risk associated with the company itself".*
- Competition: *"Assesses the aggressiveness of the market the company is acting within and the risk of market share for competing companies. A more competitive market tends to have smaller margins and hence less capacity to generate cash flows. On the other*

hand, a less competitive market is more predictable and usually favours credit risk in the short/medium term".

- Exogenous Factors: *"Government regulation and interference affect ratings given their ability to limit or support the company's ability to generate operating cash flows, as well as its predictability".*

"Business Profile" impacts the overall credit rating with a 35% weight being split equally across the seven sub-factors (i.e. each sub-factor rating weighs 5% in the overall rating assessment). The scales, according to which ratings are allocated, are also of qualitative, explanatory nature and reflect a gradual improvement/deterioration in credit risk exposure that the specific sub-factor under consideration might cause for the company *(Appendix 3).*

The fourth factor in Banco Invest's model is the so-called "Financial Policy"-factor. It is split into:

- Shareholders: *"Measures the financial capacity and involvement of shareholders in case the company requires financial support. Shareholders with good financial capacity tend not to let the company default (unless the business proves to be operationally unfeasible)".*
- Governance: *"Evaluates the transparency and separation of powers within the company. A company with independent and mutually controlling structures and responsibilities tends to be better prepared to avoid conflicts of interest that can benefit insiders over outsiders (creditors)".*
- Financial Policy: *"Management's attitude towards financial risk is a good indicator of credit risk itself, since a more conservative company will, by nature, tend to avoid negative surprises and react more favourably to creditors in case of negative events".*

Just as with the other factors, Banco Invest elaborates a 10-step scale and assigns a rating to each sub-factor according to qualitative characteristics specified in the scale. The overall weight of this factor is 15% being distributed equally among the three sub-factors *(Appendix 4).*

The rating attribution is carried out by the risk rating committee of the Bank. It is to be revised every 12 months, with the possibility of early modification in case there is evidence that the credit risk exposure of a company has changed significantly in the meantime. In case the company rating is not renewed on time, it has to be marked as expired in the respective documents. The ultimate rating score for each company is found by extensive analysis on behalf of the credit risk department on the one hand and by intense discussions with the credit risk committee and company related stakeholders on the other hand.

I.1. Outlook on Opportunities for Extensions & Adjustments

Looking in detail into the Banco Invest model as well as into the methodologies applied by the three main Credit Rating Agencies has given us the insights necessary to formulate a suggestion for possible extensions and adjustments of the model.

We decided to maintain the core structure of Banco Invest's model (four main factors as described in the previous section) as we feel that it accounts for all of the relevant perspectives credit risk has to be evaluated against. We saw this stance confirmed by the matter that the model orientates itself on Moody's approach, which is a market-wide accepted issuer of credit risk ratings. Nevertheless, we identified several aspects which appeared to have potential for modification and extension.

First of all, we decided to elaborate on the "Scale" factor. We consider it critical that "Scale" in the Banco Invest model is assigning a rating based on an assessment of the absolute amount of sales a company generates at one certain point in time.

Apart from that, we see potential for improvement with some of the qualitative sub-factors in the “Business Profile” and “Financial Policy” factor. Points of criticism on the Banco Invest model would be a certain imprecision in their formulation, a lack of clearness in their delimitation from one another and a mismatch between factor description and corresponding rating scale.

For the “Financial Profile” factor, we clearly missed a profitability ratio which we think is substantial for completeness of default risk analysis.

A further point of doubt attached to Banco Invest’s model is the fact that it does not differentiate between industries. We acknowledge the fact that a credit rating model must fulfil the requirement of being easily implementable and that distinguishing between different industries does indeed add some level of complexity. Nevertheless, we consider credit risk analysis to be a sensitive issue which justifies all complexity necessary to derive to a precise assessment. We hence decided to introduce a system of how to divide the company set into different macro-sectors and adherent sub-industries. We also adjust the factor weights according to their industry-specific impact on credit risk exposure. Before, they were mostly fixed at a 5%-rate across the majority of sub-factors which we consider to be too standardized and probably prone to imprecision.

In addition to the aspects previously mentioned, we extend Banco Invest’s model by by the introduction of probability of default measures. More concretely, we calculate Altman’s Z-score, a credit scoring model suitable for assessing the credit risk of public as well as private corporations. Furthermore, we directly estimate the probability of default through a logit regression model using a data set consisting of the Banco Invest companies and other European firms.

SWOT Analysis for Banco Invest Rating Tool

Strength

- based on methodology of well-established rating agency Moody's
- four main factors appear to build a solid framework for analysis
- procedure of working through different factors and subsequently allocating a rating by means of scorecard tables seems to be a reasonable approach for rating analysis

Weaknesses

- static assessment of "Scale" factor
- a few imprecisions in the definition of sub-factors in the "Business Profile" part of the model
- rather subjective and hardly scalable assessment of "Financial Policy" factor
- lack of differentiation across industries
- standardized weight allocation for most sub-factors
- lack of probability of default measure

Opportunities

- core model structure is easy to be built upon and helpful as outline for extensions and adjustments
- modifications shall lead to enhanced precision of final rating scores
- adoption of old features shall foster acceptance and practicability of new model

Threats

- extensions and adjustments of the model will lead to a higher degree of complexity in the assessment process
- new model is still infused by a lot of subjective assumptions which leave space for discussions and differences of opinion

II

Division into sectors and sub-industries

As previously mentioned, Banco Invest specifies one model that is applicable to the entire set of companies. However, different sectors might be affected in different ways by different credit risk drivers. Every industry has its own characteristics which translate differently into a specific credit rating. What poses a risk to one industry might not be worth concerns for another one and vice versa. Certain ratio readings might be elevated for one industry while they prove to be too low for another industry.

Hence, we suggest splitting up Banco Invest's group of 34 companies into subcategories defining clearly their industry and sector positioning.

The trade-off we encountered in pursuing this approach is the one of precision versus simplicity/implementability. Hence, our suggestion for a subdivision of companies aims to be as generic as possible and therefore easily applicable to new companies entering the analysis while still depicting precisely the specific characteristics and exposures to credit risk.

Guidance for our model is provided by Standard & Poor's Competitive Position Group Profile (CPGP) approach. First of all, we adopt S&P's breakdown into four different sectors, which are:

1. Services and branded products industries
2. Capital and asset-intensive industries
3. Pure commodity industries
4. National industries & utilities

In the appendix of the thesis report, we present an overview of Standard & Poor's CPGP industry breakdown for the aforementioned four sectors hence allowing for an accurate allocation of each company at hand *(Appendix 5)*. Moreover, we provide a table with the sector allocations for each of Banco Invest's portfolio companies *(Appendix 6)*.

II.1. Definition and characteristics of sectors

After having formally introduced the idea of an industry breakdown, we would now like to turn to a description of the characteristics for each single industry sector. Only with a clear profile of each sector in mind will we be able to later on determine the variables and the extent to which they drive credit risk in the respective sector.

1. Services and Branded Products industries

According to Standard & Poor's CPGP, the services and branded products sector is defined as:

"Brands, product quality or technology, and service reputation are typically key differentiating factors for competing in the industry. Capital intensity is typically low to moderate, although supporting the brand often requires ongoing investment in the asset base."

Typically, these are companies in consumer-facing light manufacturing or service industries. Examples include software companies, tourism and personal care.

A decisive characteristic of the services and branded products industry is its labour-intensity. Labour-intensive means that a corporation counts with a high amount of labour cost relative to its capital spending on assets that enable production and manufacturing processes. Here, manpower as a production input is key for business success. For services, this characteristic is even reinforced as labour input heavily outweighs any other capital input in this sector.

However, along these lines also appear the first issues: the services and branded products industry heavily relies on the availability of a skilled workforce that complies with the industry's requirements on abilities and knowledge. If there is no adequate personnel available, companies either need to spend significantly on remuneration, change the location of business or adjust their product and service offerings.

Moreover, the current shift from manpowered to machine-run business processes in the context of industry 4.0 poses a challenge for companies of the services and branded products industry. While they used to be labour-intensive a small while ago, current technological change forces many firms to become essentially capital and asset-intensive as it forces firms to replace workforce by machines. Being of ethically controversial nature, companies in fact pursue this way as it is indispensable once they want to keep up with productivity levels of the industry sector.

But labour-intensity does not only pose challenges. A benefit is that labour cost are contemplated as variable expenses whereas capital costs are rather considered to be fixed.

Hence, labour-intensive firms have the chance to adjust their spending in times of economic contraction by limiting their personnel base.

An additional characteristic of the services and branded products sector worth looking at is its positioning in the distribution channel. Companies in this sector receive their production inputs from suppliers and, even more importantly, directly deal with end-consumers. This has crucial implications for their business models and activities they need to pursue: building up a certain brand recognition and reputation will help them to obtain competitive advantage over competitors and brand loyalty amongst customers. Patents and licenses on proprietary products will create entry barriers for other firms and hence assure market share. Moreover, innovation is key to continuously meet and exceed customer expectations and hence create an urge for the company's products. Main considerations in this context should be of how to respond to shifting demographics, digitalization, a growing middle-class in emerging market countries as well as a rising awareness for health and environmental issues in developed countries.

The profitability of services and branded-products firms will be significantly determined by its ability to pass on fluctuations in input prices from suppliers on to end-consumers.

Cyclicality affects in particular those companies positioning themselves in the upper-end segment where price-elasticity is high. Producers of more "commoditized" goods will be less susceptible to the overall state of the economy.

2. Capital and asset-intensive industries

Moving on to the next sector, S&P's CPGP defines capital and asset-intensive industries as follows:

> *"Sizeable capital investments are generally required to sustain market position in the industry. Brand identification is of limited importance, although product and service quality often remain differentiating factors. "*

Heavy manufacturing and highly automated industries typically fall into this category. Examples include airlines, telecommunications, chemical plants or the aerospace & defence industry.

In general, capital and asset intensive industries are characterized by large financial commitments to fund operations. Once upfront investments are made, there may be economies of scale with regards to ongoing expenses and sales growth, but the initial hurdle to get into the business tends to keep the list of competitors small, creating high barriers to entry.

One can easily detect a firm of the capital and asset intensive sector by looking at the asset structure of the balance sheet. As a rule of thumb, the property, plant and equipment-account may make up well above 50% of the total asset base. Depreciation amounts are high accordingly and re-investment to retain the asset base is substantial. Companies can however modify their level of capital intensity by selling some of their capital assets off and entering into lease agreements instead. This measure is especially to be taken on in times of financial distress and provides the company with a certain flexibility.

Another good indicator to find out whether a company belongs to the capital and asset intensive sector is the relation of capital required to labour required which will by far overweight the first factor. Capital-intensive firms usually have elevated leverage ratios, but much of the debt is backed by property, plant and equipment which serve as collateral.

The credit risk attached to a company acting in the capital and asset intensive sector will be notably determined by its ability to convert revenue growth into earnings growth which is directly related to the proportion of variable to fixed cost (so-called operating leverage). If a company is not able to cut down variable cost, it will encounter difficulties in offsetting the large amount of investment it has to make in order to start production and to maintain the asset base.

Moreover, its capital intensity makes this industry prone to cyclicality in revenues and sudden decreases in sales. Such a drop-in revenue may quickly lead to shortage in cash to service debt payments since a lot of the proceeds is bound to the refurbishment of machinery.

Analysts that cover capital-intensive industries often add depreciation back to net income, hence obtaining EBITDA. Instead of using net income in performance ratios, analysts use EBITDA to mitigate the impact of depreciation, a non-cash expense, on net earnings.

3. Pure commodity industries

S&P's CPGP assigns the following attributes to pure commodity industries:

> *"Pure commodity companies have little product diversification, and tend to compete on price and availability. Where present, brand recognition or product differences are secondary or of less importance."*

These companies manufacture products from natural resources which are used as raw materials by other industries. Most oil and gas upstream producers as well as commodity food manufacturers are allocated to this sector.

Commodities are raw materials or primary agricultural products which are used as production inputs to obtain finished goods for end-consumers. Their main characteristic is the almost non-existing degree of differentiation between single products. The commodity good produced by one industry player is most of the times just as good as the one from another supplier. Commodities are said to appear on markets as homogenous goods in bulk where quality is mostly uniform. Uniformity is further on spurred by the fact that commodities must oftentimes fulfil pre-specified minimum standards to be traded on exchanges.

The main differentiating factor is the price which will hence guide buyers in their purchase decisions. Commodities' industries are therefore usually shaped by low profit margins and a tough price competition with suppliers seeking to offer the best price possible. This can only be achieved by the realization of cost-efficient production techniques and economies of scale.

At the same time, commodity producing firms encounter high spending needs in PP&E and other fixed assets to keep the production process going. The relation between high spending on capital assets and tough price competition poses one of the main challenges the industry faces. Another distinct characteristic is that purchases and sales of commodities are mostly carried out on exchanges through the use of forward contracts. By usage of this financial instrument, suppliers assure getting a fixed price on their good upon delivery in the future and thus hedge against a possible deterioration in prices. Buyers on their terms can lock in prices once they perceive them to be a good bargain. This trading behaviour is reasonable and justified looking at the high price swings, commodities are subject to. Volatility in commodity prices is due to three reasons: the first one is the fundamental state of the commodity market. Fundamental in this context deals with supply and demand characteristics which in the most basic economic sense shape prices. Hence, commodity prices will rise, if the market predicts high future demand or a scarcity in the supply of products and fall, if there is oversupply, a high level of inventories or a shrinking demand present. The second reason for commodity prices to fluctuate substantially is a more technical one which can be traced back to the theory of behavioural finance. As mentioned before, commodities are traded through future contracts, which implies that there is a lot of traders' subjective expectations about future economic development impounded in prices. These expectations might oftentimes be motivated by the same signals and indicators that traders follow. Eventually, there might be incidences of herd instincts where a lot of buying or selling happens at the same time causing prices to move substantially. Thirdly, commodity prices are sensitive to changes in the macroeconomic landscape. Events of political, regulatory or even natural origin have the potential to move prices significantly (e.g. OPEC agreeing on production cuts of crude oil or wildfires destroying a sizeable part of the harvest of a certain agricultural good).

Apart from these factors, commodities are also used a lot by speculators who do not intend to actually use the commodity as a primary input for production but who only want to capitalize on the heavy fluctuations of prices by making favourable trades before expiration of the futures contract/delivery date. This again spurs price volatility notably.

The combination of price pressure and cost efficiency on the one hand and little product differentiation and highly volatile markets on the other hand make the commodity industry an undoubtedly risky business for any company but also for investors who intend to invest their funds here.

4. National industries and utilities

Concluding with the last sector, S&P CPGP gives the following outline on characteristics of the national industries and utilities sector:

> *"Government policy or control, regulation, and taxation as well as tariff policies significantly affect the competitive dynamics of the industry."*

As one can tell by the name, this sector comprises two large sub-industries: utilities and national industries. A utility is a service provided by an organization and is intended to serve the broad public. Mainly, it is infrastructure services that the society uses in everyday life. Amongst these are water and electricity supply, sewage, natural gas and transportation. Companies acting in the utilities sector are mainly occupied with running, maintaining and updating the infrastructure of facilities. National industries include airport services, highways, rail tracks or marine ports and belong to the government. The element linking these two industries is the fact that they oftentimes have a monopoly status due to the high capital spending that the entrance of a competitor would require or due to concession agreements that eliminate competition. They are either state-run (national industries in any case) or private, and always subject to broad regulatory regimes and government control. Technological progress has lately helped splitting

up some former monopolies and one can observe a trend towards liberalization, deregulation and privatization in some markets. Taken the case of competitive markets with several players offering utility services, customers will choose the provider offering the best price as there is little potential for differentiation through observable quality characteristics.

From a credit risk perspective, it needs to be mentioned that it is typical for utility firms to carry high debt loads due to the significant infrastructure requirements they face to operate their businesses. They are hence susceptible to changes in interest rates. Another source of risk is authorities imposing new regulation which bring along the need for massive capital spending in order to be complied with.

Regarding revenues, utilities and national industries tend not to be cyclical as they provide essential services that consumers are in need of even in times of market downturn.

Oftentimes, concession agreements include tariff schemes imposed on utility companies which leads to limited pricing power but also foreseeable earnings and profitability given a good cost management.

Heavy government intervention/government ownership may provide a hedge in times of financial distress as authorities have the possibility to bail out businesses and back them with new capital injections.

II.2. Conglomerates

The inclusion of a sector breakdown into the rating analysis leads to a classification problem when there are conglomerates. S&P defines a conglomerate as a diversified company that is involved in several subsidiaries which belong to different industry sectors. It is hence exposed to different credit risk drivers. Likewise, conglomerates may also benefit from a diversification effect due to the spread of operations over different industries.

In order to estimate the rating of a conglomerate company, one has to obtain ratings on each subsidiary and weight them according to their percentage share of revenues on overall revenue generation of the firm. The diversifying effect should be accounted for favourably in the "Business Segment Diversification" sub-factor in the "Business Profile" analysis.

sector. In other words, instead of to run the model only one time it is launched as many times as macro sectors are involved.

Looking at the Banco Invest portfolio, an example of a conglomerate is RAR – "Sociedade de Controle S.A.", which comprises subsidiaries acting in the Capital and Asset Intensive sector, (Containers-packaging), Pure Commodity sector (Agribusiness and Commodity foods industries) and Services and Branded Products sector (nondurable branded industry).

III.

Proposal for an adjusted Credit Risk Model

After having introduced the importance of credit rating assessments, Banco Invest's current internal credit scoring model, the set of companies at hand as well as our stance on a possible breakdown of this company set into sectors, we would now like to turn to our proposal for an adjusted credit rating model.

The model we designed is a combination of the factors used in the original Banco Invest model, being somewhat adjusted and reorganized, inputs from Moody's and Standard & Poor's rating methodology as well as our own subjective reasoning. Our model can hence be seen as an incremental innovation to the original Banco Invest model, preserving several of the past features and building up upon them.

Hence, our model is again subdivided into the four factors "Scale", "Business Profile", "Financial Profile" and "Financial Policy".

In the following, we would like to start by presenting an illustration of our model composition that should provide the reader with guidance through the explanation of the single parts.

III.1 Model Composition

In order to define the single model parameters, we started by thinking about what the drivers of credit risk are and how one could detect them from information that is publicly available. We figured out that there are credit risk indicators on the single-borrower level that can be detected through fundamental analysis of corporate financial statements. Financial flexibility, the ability to raise capital, operating efficiency as well as management quality are also factors worth consideration.

Apart from the assessment on the individual borrower level, we also deem views on industry conditions as important. These will obviously be orientated on the definitions of the industry sectors given before and will take into account each sector's specific characteristics. Dimensions to be evaluated are, amongst others, competitiveness, regulatory interventions and impact of economic cycles.

Scale

- Revenues

Business Profile

Industry Risk

- Market Characteristics
- Expected Growth
- Exogenous Factors

Company Risk

- Competitive Profile
- Operational Efficiency
- Geographic Diversification
- Business Diversification

Financial Profile

- Leverage Ratios
- Coverage Ratios
- Profitability Ratios

Financial Policy

- Management Quality
- Capital Structure
- Liquidity & Payout Policy

III.2 Scale Factor

The first factor to be assessed by the credit risk model is "Scale". Banco Invest defines "Scale" as a measurement of company dimension. Furthermore, it assumes that company dimension

and solvency are positively correlated meaning that a company's financial solidity is supposed to grow alongside its business volume. Banco Invest measures the dimension of a company in terms of the absolute amount of revenue obtained in the year prior to the rating assessment. In the following, we would like to discuss this approach, shed light on benefits and limitations and suggest an extension to account for the latter.

In general, it is undeniable that the "scale" of a company somewhat matters for its credit risk classification. The issue is, however, how to measure scale and whether scale as a stand-alone, absolute value reveals the entire picture to be projected on credit risk exposure. Business volume grows with a broad product line, geographically diversified operations as well as a large customer base. Obviously, the larger the dimension of these factors, the more favourable corporate credit rating assessments can turn out to be. The ability to service debt payments is supposed to increase with business volume due to many reasons. Amongst them are a stable positioning of the firm in the market, recognition (and reputation) across customers or extensive and well-established relationships with stakeholders like suppliers, vendors, banks and authorities. In financial terms, these factors may translate into stable cash flows, economies of scale or reduced cost of capital rates which will ultimately support the company in servicing its debt payments.

Sales as the first line in the income statement is an easy to read metric which might give an initial idea about the aforementioned characteristics. However, prudent handling of this figure is advisable. The credit analyst needs to explore the sources and dynamics underlying to the figure he reads. He should wonder whether sales have been growing or decreasing throughout the last periods, that is to say whether the company has been expanding or contracting operations. Furthermore, a look at the stability over time appears crucial for default risk considerations. Given a lot of volatility in sales, the security at which a company will service debt payments is questionable. For exceptionally good or bad readings on sales, it should be

questioned if they were generated by one-time events (e.g. currency effects) or if they were caused by recurring circumstances. It is as well worthwhile asking if the company has been able to produce sales out of own strength or if they have been generated by acquisition of external businesses units (i.e. inorganic company growth).

As one can tell, there are a lot of careful considerations to be made while analysing sales. Only looking at absolute values without the necessary context and trends in mind hence does not seem to be enough.

Apart from that, sheer company size should not be an exclusive argument. There do exist small enterprises which also possess of competitive advantages and dominant market positions. They may be niche providers of really specialized products or may serve a very focused market. Their business model will enable them to generate revenues which are just as adequate to service debt payments as the one from bigger companies, where, in fact, not only amounts of revenue tend to be higher but also the cost incurred to produce them just as the quantity of debt borrowed in order to finance operations.

We do acknowledge undoubtedly that there are not only these highly differentiated niche providers in the market of small- to middle sized enterprises. It seems also true in many cases that small companies may lack the operational and financial flexibility as well as diversification necessary to ensure a smooth flow of operations and cash. Particularly during times of adverse developments in the overall economy, small companies are the first to be driven out of markets since customers turn away more easily or banks are more reluctant to conceive credit to them. Small companies lack the scope to absorb such contractions just as they lack the access to trustful creditors or shareholders who may back them up with new capital injections.

Nevertheless, we advocate not to take business volume as a benchmark for default risk per se. Small companies should not be “punished” by the pure size of their operations. (In case one could even think of this as circular reasoning where small companies face detrimental credit

ratings which causes spreads and interest expenses to rise, a matter that could eventually really affect their solvency).

To resolve this shortfall, we suggest extending the analysis of the scale factor. We retain the rating attribution for certain quantities of revenue as suggested by Banco Invest since it seems a good foundation for the analysis of scale.

Going back to the very beginning of this paragraph, the original argument was that a company's creditworthiness increases alongside its business dimension. We would hence like to propose return on invested capital (ROIC) as an additional measure which is able to capture growth in business volume in order to complement the analysis of sales. It shall serve as an additional reference, the initial assessment derived from the revenue analysis can be evaluated against.

From a theoretical point of view, ROIC indicates how much money a company earns on each dollar it invests. It is calculated as

$$\text{ROIC} = \frac{Net\ Income}{Invested\ Capital} = \frac{Operating\ Income\ x\ (1-tax\ rate)}{Total\ Asset - (Current\ Liabilities - Short\ Term\ Debt)}$$

To allow for a comprehensive analysis, ROIC needs to be set in relation to the corporate weighted average cost of capital (WACC). WACC is a measure of how much a company pays for its sources of external financing and implicitly accounts for the riskiness involved in the entity's operations. Whenever ROIC exceeds WACC, the company is effectively creating value, as its return surpasses the cost incurred for investments. On the opposite, if the difference between ROIC minus WACC yields negative results, the company is destroying value. We think that ROIC is hence a powerful measure to complement sales as it is not only a snapshot of a company's business volume at one certain point in time but allows for a real assessment of value creation and future prospects of the firm. Additionally, the relationship holds that a higher ROIC will directly translate into higher cash-flows, which will ultimately

improve the firm's ability to pay for its debt. Another valuable feature of ROIC is that it facilitates the computation of the firm's growth rate g:

$$g = investment\ rate \times ROIC$$

where "investment rate" is the fraction of earnings that is being retained and reinvested in the firm. We think that knowing about the rate, a company grows at, could be an additional interest aspect when assessing the business dimension of a firm. We reinforce to note, however, that g by itself will not lead to any value creation, it only acts as a magnifier of the relationship between ROIC and WACC (value creation if ROIC > WACC, value destruction, if relationship is inverse).

The computation of g is especially interesting on the long-term perspective. One assumes that at a certain point in time, returns and investment levels will stabilize as the firm reaches a mature state. Hence, any long-term growth in cash-flows will be directly tied to the growth in revenues. We think that this consideration additionally underpins our combined analysis of ROIC, revenues and the growth factor g.

Apart from the aspects mentioned before, we think that ROIC is a suitable supplement for the scale-factor analysis as it considers business dimension from an investor's point of view. From our perspective, the sales metric gives a notion of the client-side of the business, more precisely of quantities and prices customers are purchasing a firm's products. When evaluating credit risk, we might however also want to look at the business from the (debt) investor's point of view to know how much (if any) value is being created with our initial investment. We think that this might have explanatory power for the likelihood of recovering the principal investment and gaining the promised return as indicated by the WACC.

The scorecard for the rating attribution of the "Scale" factor can be found in the appendix of the report *(Appendix 7)*.

III.3 Business Profile

Just like the "Scale" factor, the "Business Profile" factor is already existing in the original Banco Invest model, but got modified and extended in its function for our new model.

We perceive credit risk to be determined by factors residing on both, the macroeconomic as well as the microeconomic level. Therefore, we chose to divide "Business Profile" into two major groups of sub-factors, "Industry Risk" and "Company Risk", a systematization that is absent in the Banco Invest model. "Industry Risk" in this context captures macroeconomic drivers of credit risk, whereas "Company Risk" refers to potential sources of risk from the microeconomic level of the firm. By systematising the structure of "Business Profile" in this way, we would like to simplify the analysis of all the possible drivers of credit risk and facilitate some clearness in their delimitation from one another. By doing so, we avoid that certain drivers get accounted for twice while others are left out of the analysis, shortfalls that we see in some instances with the Banco Invest model. We think that a clear definition of all the sub-factors being bundled in "Business Profile" is especially important, since it is a purely qualitative factor where there is a lot of human judgement inherent, a matter that requires an even more structured approach to obtain fairly objective and comparable results.

Eventually, all the factors described in the following may potentially drive credit risk in a sense that they hamper the generation of cash-flows, cut revenues and operating margins or increase corporate leverage levels and should be assessed by the credit risk analyst against this background.

Industry Risk

Our rating analysis of "Business Profile" begins with an evaluation of the broad environment the company is acting in. In order to understand the drivers of a company's creditworthiness, it is crucial to assess the attractiveness and dynamics of the market, its future prospects, key challenges and levels of competition. Moreover, the analysis on a macro-level also sets the

stage for evaluating the company on a micro-level (e.g. if the overall market is determined by tough competition, the analysis of a company's competitive position in this market needs to be stressed). Hence, we set "Industry Risk" analysis to come first in our consideration of "Business Profile".

1.) Market Characteristics

The first sub-factor "Market Characteristics" considers the size of a market. Size in this sense is determined by the magnitude of the customer base and its ordinary demand. The credit risk analyst should hence look at the number of customers a corporation is currently serving, the potential of enticing away clients from other market players and the risk of customers switching to competitors' offerings.

Apart from the ordinary levels of demand, "Market Characteristics" also assesses the magnitude and reasons of possible fluctuations. Special attention in this context has to be paid to cyclicality meaning whether demand is prone to fluctuations in the economic cycle or whether it remains fairly stable throughout market up- and downturns.

Other aspects to be considered is the price and income elasticity of demand. Depending on the type of goods/services produced, customers might show a different degree of responsiveness in terms of adjustments of their optimal consumption choice given the fact that prices or income change. In general, in the case of essential goods, an increase in price does not substantially change the quantities consumed. On the contrary, luxury goods tend to have a lower demand rigidity, henceforth a small change in price or incomes available significantly affects the quantities consumed.

2.) Expected Growth

Expected Growth corresponds to potential market growth. While the previous factor analyses the status quo demand and certain product/service characteristics that may impact demand (e.g. cyclicality, elasticity), this sub-factor looks at the future prospects of demand. Only if demand

grows, a market can gain in volume. Important here is to understand the drivers of future demand and to recognise its upper limit from which on the market is saturated.

To start off, it proves helpful to look into the lifecycle stage of the market. In general, markets pass from an introduction, over a growth onto a maturity stage. Early stage markets exhibit a lot of growth but at the same time, are a risky endeavour since future demand is pretty uncertain and unstable. Mature markets on their terms provide companies with more stability but also entail little chances to grow beyond existing levels.

In general, markets that tend to grow over time are innovative (technology-driven) markets where a lot of new products are generated. If the consumer perceives them as value-adding, he will strive to purchase the product which ultimately generates revenue for the company.

Stable markets are those providing goods that are not subject to major fluctuations in customer demand.

Declining markets, in turn, comprise goods that are somewhat outdated or do not represent any value added that customers are willing to spend money on.

Whether markets grow, also depends on their positioning in the supply chain: primary factor inputs will be dependent on growth in downstream markets while finished goods markets will directly be influenced by end consumer needs.

Another reason which is hampering market growth are entry barriers. These are typically high when the market is capital intensive meaning that it requires high capital expenditures to be made previous to the start of operations. Highly regulated industries may also be shielded by high barriers to entry e.g. through government imposed limitations on market participants, concession agreements or tender offers.

3.) Exogenous Factors

Our definition of "Exogenous Factors" is similar to the equally-named sub-factor in Banco Invest's original model. It contemplates all influencers on credit risk that cannot be controlled by the company or industry. These factors lie beyond their scope of action. Namely, these are regulatory regimes and government interferences, tax policy, trade and concessions agreements and tariffs, amongst others.

A firm should care about the stability and strictness of the regulatory environment and understand implications of new policies on operating requirements and financial results.

Furthermore, labour related aspects are to be mentioned, e.g. the impact of labour unions, strikes and unrest as well as scarcity of workers whose skill set matches job requirements. These factors all have the potential to adversely affect a firm's operations and may hence lead to disruptions in flows of income.

In addition to the previous, manmade and natural catastrophic events should also be accounted for. Typically, these are low probability events, nevertheless, whenever there are hints for their occurrence, they should be included in the model due to their heavy impact.

Company Risk

Having evaluated the broad, external environment, a company is acting within, our credit risk analysis now turns to sub-factors that trace risk drivers referring to a firm's micro-level. The analysis shall allow for detection of weaknesses stemming from the firm's strategy, competitive positioning and operations that have the potential to negatively impact corporate creditworthiness.

1.) Competitive Profile

"Competitive Profile" is all about the competitive advantage that a firm might have over its peers acting in the same industry. Competitive advantages can be originated in various parts of

the company, given that they differentiate the firm from its competitors in a decisive manner and hence have the potential to substantially add value.

To explore, whether a company has a competitive advantage, the credit risk analyst should work alongside the following categories:

- *Business model:* in general terms, a business model describes the rationale of how a firm is generating revenues and creating profits. To set up a successful business model, the firm needs to be clear about its value proposition for the market. A value proposition is a precise statement about a firm's product and service offering and in how far it is able to create value for its clients, leaving it with a competitive edge over its competitors. Competitive advantage, in turn, can be obtained through a unique and distinctive product/service palette and the degree of innovation attached to them.
- *Strategy:* "Strategy" and "Business model" are closely related to each other, however, strategy explains more the way of how a company plans to realize its business model. Michael T. Porter defined in 1980 three main types of strategies, firms can adopt in order to realize their business model and achieve their corporate goals. Namely, there are cost leadership, differentiation or focus strategy. "Cost leadership" focuses on being the best cost provider, "differentiation" aims at setting a company apart through a unique price-product combination while "focus" tries to target a niche market, that no other player is able to serve. Competitive advantage will be reached, if the company is the best amongst its peer group in implementing the strategy chosen.
- *Marketing mix:* a firm can also obtain competitive advantage through its mix of marketing instruments. Through adequately addressing its target market, a firm can create brand strength and brand reputation which leads to increased market recognition and customer loyalty.

- *Distribution channels:* well established distribution channels are a way to increase customer satisfaction and represent a service to clients, especially in the fast-paced times that we live in nowadays. A firm needs to hence design logistics carefully and think about online and offline channels to approach and please customers.
- *Technological progress:* Leveraging technological progress will bring a corporation ahead of its competitors. Technological progress can come in many different shapes: it can either refer to technological excellence in the manufacturing process, in the supply chain or can relate to the specific product offering itself. Technology-driven firms being able to release innovative, edge-breaking products to the market are amongst the most successful in terms of profitability and value creation.
- *Entry barriers (micro-level):* whenever a firm is able to restrict its competitors' access to a specific market, it counts with a true competitive advantage. Apart from limited access of new competitors, clients on their side will experience high switching cost, in a sense that there is no other provider to turn to or changing providers comes at an opportunity cost of foregone benefit that could have been realised by staying with the original company. Entry barriers come e.g. in the form of unique access to scarce resources or trademarks and patents.

2.) Operational Efficiency

Value creation happens along the production and supply chain of a company. The margin between income generated and the cost that needed to be incurred ultimately determines the profitability of a company. A company which has efficient operations can increase margins and generate substantially more value for its stakeholders than its peers.

When evaluating how efficiently a company is transforming production inputs in outputs, the credit analyst should take into account the following aspects:

- *Cost management:* operational efficiency can be enhanced by increasing the output amount per unit of input or lowering the input amount per unit of output. Both can be attained through good cost management.
- *Economies of scale:* Economies of scale is tightly related to cost management. It results from the inverse relationship between production amount and per-unit fixed cost and means that a company is getting more efficient because of synergies and scale effects.
- *Flexibility in capital outlays:* a company's ability to react to market conditions is of great importance in terms of operational efficiency. Once markets are in contraction and demand is low, a firm must be able to reduce its output amount, while in times of economic upswing, it must have the capacity to extend operations in order to capture returns. This is only possible if a firm has access to financing, be it from equity or debt markets.
- *Capital intensity:* there are industries that require huge capital investments to either start production or maintain property, plant and equipment during the production process over time. For companies where this pattern is applicable, it is even harder to obtain operational efficiency since they have to invest money on an ongoing basis in order to keep production going. Having a vigilant eye for cost and the return on capital expenditures is hence crucial due to their magnitude and frequency.
- *Resource utilization*: Resource utilization is as well closely tied to the cost reduction and economies of scale motifs. Only companies who are able to optimize plant capacity and utilization rates while at the same time reduce idle times and waste of production inputs will attain operational efficiency.
- *Inventory management:* the "just-in-time" principle is common to firms with the highest operational efficiency. It means that inventory levels are usually kept as low as possible and are only enough to service immediate demand. The reason behind is that there are

costs attached to inventories - e.g. storage cost or indirect cost of quality deterioration caused by the delay in usage - that can be avoided if production quantity matches demand quantity.

- *Bargaining power with vendors:* operational efficiency will also be determined by a company's position in a product's overall manufacturing and marketing process. Roles can be, among others, the supplier of primary inputs, the manufacturer in the production process and the retailer/wholesaler marketing the product to the end-consumer. Depending on the supply/demand relationship, some players in this chain will be provided with more bargaining power which will enable them to dictate prices.

3.) Geographic Diversification

The sub-factor "Geographic Diversification" contemplates diversifying effects from extending businesses to multiple geographies. In general, international diversification may decrease a firm's exposure to credit risk in a sense that adverse developments in one market may be absorbed by positive trends in other markets. If geographic markets are chosen carefully, international diversification may lead to cost savings, economies of scale and a broader customer base. However, it can also introduce complexity e.g. through currency translation effects as well as exposure to country-specific risks which can be of political, natural or social origin.

Actually measuring the risk exhibited by different nationalities turns out to be challenging because we cannot compare the benefit of international diversification across developed markets (low risk countries and with stable currencies) with diversification into emerging markets (high risk countries with unstable currencies). The easiest and most efficient method for an adequate assessment of country risk seems looking into where a company's revenue comes from. Taken the case that a company generates 50% of revenue in "safe countries" and the remainder in "risky countries", the final diversification riskiness will be equal to the average

between the respective country ratings weighted according to the respective amount of revenue generated. In order to be able to set up a rating table for “Geographic Diversification”, we decided to distinguish between “low risk profile diversification” and “high risk profile diversification”. We assumed that every time the average calculation resulted in values higher or equal to a 6/BB-rating, geographic diversification is classified to have a low-risk profile, while every time the rating is lower than 6/BB-rating, it represents a high-risk profile. In the excel model accompanying the report, there is embedded a detailed table by Moody’s with current sovereign ratings that are used for the calculation of the rating for geographic diversification.

4.) Business Segment Diversification

Business segment diversification refers to the portfolio of industry sectors a firm acts within. An entity can have different lines of businesses or it can be a conglomerate, bundling different, independently operating subsidiaries under its umbrella. Here again, diversification may provide a proper hedge against downturns in one specific industry as they may be offset by upswings in another one. However, if the industries are highly correlated and move alongside, no diversification effect will be realised. Furthermore, being present in different industries definitely extents complexity and the expertise required to run the business which may ultimately pose a true challenge to the firm’s management.

The credit analyst hence needs to consider carefully, how well a company manages its diversification into different segments and whether aggregate credit risk exposure gets diminished when compared to the sum of the single risk exposures of the different business units.

To allow for converting the factor assessment in an actual rating score, we again developed our own scorecard for the “Business Profile” factor which can be found in Appendix 8.

III.4 Financial Profile

"Financial Profile" is a rather quantitatively inspired part of our credit rating model. It is a deep dive into the firm's solvency and financial coverage which, by means of ratio and margin analysis, shall provide a differentiated picture of the company's financial health.

"Financial Profile" essentially maintains most of Banco Invest's analysis approach. However, we introduced three modifications: we added a profitability ratio, decided to limit the use of the (Funds from Operations-Capex)-to-debt ratio and we differentiated among sectors meaning that we adjust the relative weightings of the ratio variables according to sector characteristics. Our rationale for including a profitability ratio was that we deem the ability to generate profits to be indicative for a company's survival on the medium to long-run. (FFO-Capex)/Debt has been substituted by FCF/Debt and RCF/Debt ratios in order to better account for financial flexibility stemming from changes in working capital and capital expenditure.

In the following, we will discuss the composition of the ratios, their meaning as well as the implications that can be drawn from them on the issue of financial stability and corporate solvency.

Leverage Ratios

A leverage ratio is any kind of metric that sets an entity's level of debt in relation to other information from corporate financial statements. The most common leverage ratios are the debt-to-total-assets and debt-to-equity ratio. They are indicative of the sources of financing a company is using to fund its operations. The capital structure of a business typically has significant impact on its profitability and solvency. It determines the cost of capital an entity needs to be able to pay for as well as the rate of return it can obtain from its investments and operations.

Being highly levered means using a significant part of debt financing in the capital mix, a matter that can fuel growth in case a business generates more return on debt than it is paying for. On

average, investors require a smaller rate of return on debt than they do for equity investments. An additional perk of using debt is the tax deductibility of interest payments which effectively lowers the tax expense a firm has to pay for. Nevertheless, choosing elevated levels of leverage is also a risky endeavour, particularly in times when a business is in decline. Debt, other than equity, incorporates fixed claims from investors that need to be serviced. If the firm cannot fulfil these claims, it has to file for bankruptcy. Debt is hence a risky business whenever there is a lot of volatility in sales and the earnings derived from them.

- *Debt-to-EBITDA ratio:* Debt-to-EBITDA sets an entity's borrowings in relation to its earnings before taxes, depreciation and amortization. Debt-EBITDA ratio reflects the amount of debt that needs to be paid for from the operating cash earnings still including non-cash expenses like depreciation and amortization. It can also be interpreted as the amount of time a business would need to pay down all of his debt positions by using its operating income. Not subtracting depreciation and amortization charges is especially relevant for capital-intensive industries where the amount of non-cash expenses per period are high. Subtracting those may lead to distortions in the picture of how much cash a firm really has at its disposal to pay for debt obligations.

  Debt-to-EBITDA has proved to be a reliable indicator for the financial health and solvency of a company and is one of the key ratios commonly used by creditors and rating agencies. Due to its informative power, it is frequently included as covenant in loan agreements where it requires debtors to stay below a certain threshold value.

Interest Coverage Ratios

Coverage ratios represent another group of metrics which aim at gauging a company's ability to pay for its financial obligations.

- *EBITDA-to-interest ratio:* Interest coverage ratios divide operating income by the amount of interest expenses incurred. In general, interest coverage ratios reveal how many times a business is earning its interest expense.

  There are two critical points that one should keep in mind when assessing this coverage ratio: EBITDA-to-interest expense tends to deliver higher readings than EBIT-to-interest expense because the numerator is larger. The difference in ratios is especially large for industries that entail high amounts of depreciation and amortization. EBITDA coverage ratio will hence produce a more liberal indicator of a firm's debt payment capacity while EBIT coverage ratio leads to more conservative results.

  Regarding the denominator of the ratio, one could potentially argue that interest expense does not cover the full amount of fixed claims that come from the use of debt instruments. A firm might as well default if it misses out on the principal repayment. Choosing the total-debt-service coverage ratio (EBITDA/(interest expense + principal amount)) instead of interest coverage ratios may fix this problem.

Cash-flow coverage ratios

In contrast to the aforementioned interest coverage ratios, cash flow coverage ratios set cash flow statement measures in relation to total debt loads. They shall serve as an indicator of the entity's ability to service debt payments through the use of different types of cash flows it has at hand.

- *Retained Cash Flow-to-Net Debt:* This ratio compares cash flow before working capital movements and capital expenditures and after dividend payments to total debt. It is helpful to gauge the availability of cash to repay debt after shareholder interests have been paid for. It is particularly useful for companies that pay high cash dividends since those ultimately represent a restriction in the availability of cash to pay for interest

charges. By excluding any changes in working capital and capex, RCF-to-Debt gives a notion of financial stability before making any decisions about re-investment into current or fixed assets. We use this ratio consistently throughout the different sector models.

- *Cash Flow from Operations-to-Debt:* This ratio sets cash flow after working capital movements and dividend payments in relation to total debt. The importance of this ratio (and the reason for why we removed (Funds from Operations–Capex)-to-Debt) lies in the role of working capital. Working capital is a key influencer of a company's cash flow generation. Companies which are working capital-intensive can reduce potential losses during market downturns by selling off inventories and investing in a lower amount of raw materials. Both actions will reduce the amount of funds that is tied up in working capital and will free up new cash for debt repayment. Funds from operations, however, is entirely excluding any effects from adjustments in working capital. We hence think, that cash flow from operations is the more suitable measure as companies can use their flexibility in working capital levels to smooth stressed cash levels in times of solvency affecting events. We decided to use this ratio for the "Services and branded products sector", because high levels of working capital are a special feature of the industries bundled there.
- *Free Cash Flow-to-Debt:* The same reasoning as in the previous paragraph can be applied for FCF/Debt with the difference that this time, additionally to working capital movements, also capital expenditures are accounted for in free cash flows. Particularly capital and asset-intensive companies may or may not have flexibility to cut capital expenditures in times of financial distress. Some might be able to because they can postpone their investment in property, plant and equipment while others will be forced to maintain their levels of outlays due to the nature of their business. Given a business

has some sort of flexibility, this might be helpful in times of market downturns, as more cash will be left over for debt repayment. We use this ratio in the "Capital and asset-intensive", "Pure Commodity" and "National Industries and Utilities" sector, since capital outlays are of significant magnitude there.

Profitability Ratios

Profitability metrics are one of the most common tools in financial analysis. They are able to capture a firm's operating efficiency and ability to realize economies of scale and hence deliver valuable insights on operating performance. Profitability analysis can make use of two types of measures, margins and returns.

- *EBITDA margin:* Since a profitability ratio was absent in Banco Invest's model, we have decided to include EBITDA margin as a fifth ratio. It is calculated as EBITDA divided by revenue and thus indicates the relation between revenues and the amount of revenues which is left after paying for both, cost of goods sold and operating expenses such as wages, raw materials. EBITDA margin can be understood as a measure of efficiency of operations as well as an indicator of managerial skill since the type and amount of operating expenses a company faces will mainly depend on management's decisions. Due to this informational value attached to EBITDA margin (it exactly represents the cut between operating, non-cash and financing expenses), we consider it more suitable for credit risk analysis than gross margin ((revenues-COGS)/revenues) or net margin (net income/revenues). Gross margin does not seem suitable because it does not include all expenses incurred by operations and hence overstates the relationship between income and revenues. Likewise, net margin does not appear to be a good profitability measure because it includes effects from aspects that the firm cannot have any impact on, like tax payments.

All of the aforementioned ratios are computed using financial statement data of the last year available before rating assessment. The scorecard table for the "Financial Policy" factor can be found in Appendix 9. Threshold values for the classification of a company into a specific rating notch are based on research by Moody's (references in the appendix) and Banco Invest's original tool. Over the long-run, they would need to be reviewed and verified to secure that they correspond with current market conditions.

Moreover, it seems advisable to start the analysis by calculating ratios based on figures of the most current financial statements but then substantiating these values by ratios from previous years. In this way, credit analysts can detect major fluctuations from non-recurring events that may impact the precision of the rating outcome. Moreover, they will get a sense of the tendencies in financial ratios over time which is a useful add-on for the rating analysis.

As a final remark, credit analysts might as well not want to stop by only performing financial ratio analysis for the company to be rated but also search for ratios of closely related peers, they can benchmark their ratios against.

III.5 Financial Policy

The fourth and last factor of the default rating model is "Financial Policy". The original Banco Invest model considers the accessibility of additional financing granted by shareholders, the transparency and separation of powers within the firm and management's general attitude towards risk.

We thought that this set up of the factor did not capture all the relevant variables that drive credit risk. Henceforth, we restructured "Financial Policy" and now evaluate the quality of firm management, its choice of capital structure and the liquidity situation. "Financial Policy" shall thus account for the "human factor" in default risk in a sense that all of the aforementioned aspects are actively driven by business executives' attitudes, reasoning and choices.

Quality of Firm Management

"Quality of Firm Management" directly assesses the performance of persons in leadership positions at the respective firms.

This sub-factor might be hard to assess though when being an outsider to the company. Moreover, each credit analysts may come to a different judgment in light of the subjectivity involved in the assessment. Facing these difficulties, we will subsequently present three categories, management quality can be evaluated against. These categories shall serve as a guideline to the credit risk analyst and shall make the grading of management quality transparent and comprehensible.

- *Leadership & Agency Conflicts:* A good way to start the analysis of management quality seems to be searching for evidence of strong leadership and a vigorous corporate culture. Indicators are e.g. the degree of fluctuation in top management positions or the extent to which management's and employees' interests and goals are aligned to each other. Furthermore, it also seems advisable to consider the overall reputation and track record of past performance of key positions like the one of the CEO, CFO or COO. Certain managers will be known for responsible, sustainable leadership while others may have made a name for their risk-loving behaviour and a lack of reasonable judgement. Closely following up on news and press releases about the firm to be rated are probably the best approaches to address these categories. Looking into whether the firm is a family business or a multinational conglomerate might also play a role. Usually, executives of family offices are tied to the business more closely because it may be inherited and passed on over generations. In this case, executives do not only represent the management but also the owners of the firm. In contrast, for big multinational conglomerates, managers (who do not hold any significant ownership position) may not feel as related to the core of the business. They may rather perceive the firm as a "value-

generating unit" and try to exploit its resources as much as they can – at the risks this may involve. They may care more about maximising shareholder value than they care about the safety of generating stable cash flows to service debt investors' claims - a phenomenon commonly known as agency conflicts. Agency problems among business executives have the potential to affect the solvency situation of the company significantly.

- *Compliance:* Another aspect to be looked at when rating management quality is its compliance with regulatory and accounting regimes. A prominent case where management did not comply with accounting standards was the fraud committed by Worldcom in 2002. After incorrectly accounting for $3.8 billions of operating expenses over five quarter's time, Worldcom had to file for bankruptcy when an internal audit uncovered the fraud.
- *Corporate Actions:* A less apparent but still helpful indicator to explore management quality may be corporate communication. For example, one can find out if there have been any ad-hoc statements or press releases during incidents of bad (credit-risk affecting) news or if management rather tried to conceal adverse information until the last moment possible. Given the fact that management commits to timely disclosure will leave investors reassured that they do not have to fear of being caught by bad surprises. In case, proper communication is absent, there are certain observable actions, management tends to engage in in the presence of solvency problems:
  - dropping dividends to free-up more cash for debt repayments;
  - changing operations to reduce operational risk that spurs a possible default;
  - issuing equity;
  - issuing or rolling over debt and renegotiating borrowing terms;
  - selling off assets;

- engaging in M&A activities in an attempt to sell the whole firm.

Naturally, none of these actions can be seen indicative of solvency problems as a stand-alone argument. Nevertheless, if the evaluation of management performance turns out to be unfeasible due to non-accessibility of information, looking for these activities might be helpful in gauging credit risk exposure.

Capital Structure

We already quantitatively analysed capital structure decisions in "Leverage Ratios" in the "Financial Profile" factor. Nevertheless, we would like to dedicate some qualitative analysis to the choices of financing as well since we consider them crucial for default analyses. We will not assess capital structure from a corporate finance point of view where concerns are centred around the optimal capital structure which maximizes firm value. In our case, we rather look at the composition of capital structure from a risk perspective. All of our analysis will centre around the questions of which types of financing instruments are used and what their implications on credit risk exposure are.

- *Characteristics of Debt Instruments:* Debt securities can differ significantly in terms of their characteristics and hence their risk profile. Credit analysts should run along the following aspects when evaluating credit risk inherent in different debt instruments:
  - *Seniority:* the seniority of a debt instrument reflects where it ranks in terms of priority of its repayment. In general, debtholders are the first in line for repayment of their claims, shareholders follow thereafter. Amongst debtholders, the ones holding "senior" securities will be paid with priority to the ones holding "junior" securities. Senior loans hence offer debtors some sort of downside protection in case of a default event.

- *Security:* there are secured and unsecured fixed income instruments. The ones being secured pose collateral meaning that they are backed by a real asset of the same value that the creditor has a claim on in case the company cannot pay back debt with cash. Unsecured bonds are "bare" in this sense, meaning that there is no insurance provided for them. If the company goes bankrupt, all of the debt investment will be gone.
- *Covenants:* a covenant is an agreement attached to a debt instrument determining certain activities that will or will not be carried out in future. For example, documentation of a newly issued loan security might state the extent to which a company is allowed to increase the level of leverage thereafter. Covenants can also come in form of financial ratios a company commits itself to meet or they may fix the level of dividend payments or working capital. All of these measures serve as protection for the debtholders, as they are supposed to limit the exposure to default risk. If a lending firm breaks a covenant, the debtholder usually has the right to call back his obligation at immediate effect. A company's track record of compliance with covenants might on top represent a good indication for its attitude towards credit risk.
- *Credit Enhancement:* credit enhancement is a tool used to obtain better conditions for outstanding debt. The borrower wants to hence reassure the lender of its creditworthiness by providing e.g. personal or parent company guarantees on its debt securities.
- *Variability of interest rates:* interest bearing debt instruments can require fixed, floating or variable rate payments. Floating and variable rates are riskier because debtors will not be able to know upfront what they have to pay in interest expenses.

If a company readily provides covenants, poses collateral as a pledge or has any form of credit enhancement in place, it can arguably be seen as lower risk investment as there are certain hedges against the adverse effects from credit events.

- *Accessibility of Sources of Financing:* There are different sources of financing a company can dispose of, namely internal financing through earnings and external financing through debt and equity capital markets. While it is desirable to rely on internal sources of financing as much as possible, most companies will have to turn to capital markets at a certain point in time in order to fund investments that surpass internal resources. We have already discussed the characteristics of debt instruments that can make up a part of corporate capital structures. However, it is also worthwhile figuring out how well the company can access other sources of financing given that debt accessibility is exhausted and funding needs are still present. This ability is particularly important from a credit risk point for view for instances where interest payments have to be made but cash resources are exhausted.

  Aspects to be considered are:

  - is the company able to raise equity financing with ease given that it has reached its limit of credit exposure but still needs additional resources? Trust and reputation on equity markets play a significant role as well as the firm's past development of share price and payout policy
  - are there any stockholders with a major stake that are likely to back up the company with new capital injections even in times of financial distress?
  - does the company have well-established relationships with banks? does it raise financing from several different banking institutions or does it only rely on one key contact?

- is the firm also able to exploit alternative sources of financing like venture capital or private equity?
- Is the firm eligible to receive government aid or is it even state-run and hence backed up financially by authorities?

Liquidity & Payout Policy

In broad terms, default risk is the risk of falling short of financial resources to make debt related payments when they are due. In the "Financial Profile" factor, we analysed corporate solvency by means of leverage and coverage ratios. In the following, we would like to shed light on the liquidity situation of a firm. Solvency and liquidity, though both describing an entity's ability to service debt payments, differ from one another in their meaning. Solvency assesses the capacity of meeting long-term financial obligations. It evaluates whether a business owns more than owes. Liquidity is more tilted towards the ability of meeting short-term commitments and of converting assets into cash quickly.

- *Liquidity Situation:* In order to analyse the liquidity situation, it is necessary to look at positions of current assets and current liabilities on the corporate balance sheet. Current commonly means that maturity for these obligations lies within the reach of one year's time. The relation of the amount of assets to the amount of liabilities as well as assets' convertibility into cash will be indicative for the firm's financial health.

  Current assets are: 1) Cash and cash equivalents, 2) Short-term investments, 3) Receivables, 4) Prepaid expenses and 5) Inventories

  While the first item really indicates how much liquidity the firm has at immediate disposal, all of the subsequent captions are supposed to be converted into cash within 12 months. Inventories count with the longest time to cash, since they first have to be converted into a receivable position after being sold, which will subsequently be turned

into cash. Short-term investments are closer to be cashed-in, since they are normally directly marketable.

With regard to credit risk analysis, it seems fruitful to thoroughly walk through each short-term caption on the balance sheet and evaluate the risk potential attached to it. To give an example why this is useful, one should consider accounts receivable for a moment. While its absolute reading will increase the amount of total current assets and hence the magnitude to which short-term debt payments can be serviced, nothing is said about the probability that they will really be converted into cash within one year. Firms indeed have defaulted in the past because they sold assets to clients on a term payment agreement, booked an accounts receivable position accordingly, but eventually never got paid by the client due to diverse reasons.

Another example is inventories. If the company shows high levels of inventories, credit analysts need to keep in mind that this might lead to additional cost: on the one hand, there are direct cost like the ones for storage and on the other hand there might arise indirect cost from a deterioration in the goods' quality or a decline in market prices up to the point they get sold. Moreover, it is also evidence of a lack of management skill to plan operations according to current demand. Hence, just-in time production and limited inventory levels should be considered favourably for in credit risk assessment.

The counterpart of current assets are current liabilities. Short-term obligations can be commercial paper and notes, but also payments to suppliers fall under this category. Typically, they appear on the balance sheet under the following captions: 1) Trade payables, 2) Short-term debt and 3) Accrued liabilities.

Current liabilities represent the debt claims that come due in the near-term future and that need to be serviced in case to keep the firm's operations going. Hence, incoming cash-flows streams of a firm should be at least sufficient to pay for interest and principal

payments caused by short-term assets. Following the idea of matching short-term assets with short-term liabilities, the credit risk analyst can have a view on the reading for working capital as it represents the difference between these two groups.

All of the aforementioned balance sheet items are used to calculate the following liquidity ratios. There are:

$$\text{Current Ratio} = \frac{Current\ Asset}{Current\ Liabilities}$$

$$\text{Quick Ratio (or acid test)} = \frac{Cash+Short\ Term\ Investment+Receivables}{Current\ Liabilities}$$

$$\text{Cash Ratio} = \frac{Cash+Short\ Term\ Investment}{Current\ Liabilities}$$

As we can tell from the ratios, all measures indicate the ability of near-cash assets to pay off current liabilities. The ratios only differ in what they include in the numerator. While the quick ratio excludes inventories to only account for real "quick" assets, the cash ratio is even more restrictive by only including assets with almost immediate liquidity. Calculating these ratios and benchmarking them against ratios obtained for close competitors may be a useful value-add for the credit risk analysis.

Another useful metric to be considered for liquidity analysis is the cash conversion cycle (CCC). It returns the number of days a company needs to convert each investment in operations into cash-flows obtained from sales to customers. It is calculated as

$$CCC = \frac{average\ inventory}{COGS/365} + \frac{average\ accounts\ receivable}{COGS/365} + \frac{average\ accounts\ payable}{(inventory\ increase+COGS)/365}$$

The shorter this time span, the more efficient a business is in converting financial resource inputs into cash-flows. For some industries, CCC can even turn negative. Especially retailers which exercise a lot of power over suppliers will build up large payables position and first pay them off a good while after they have collected form

clients. This effectively gives them a type of time-restricted credit they can use to invest or pay for immediate debt obligations.

- *Payout Policy:* Apart from capital structure decisions, management will also determine a payout policy at which a firm makes dividend payments to its shareholders – or not. According to Modigliani & Miller's *dividend irrelevance theory*, payout policy does not matter in a frictionless market because, if not distributed, earnings will be incorporated favourably in the market's assessment of a firm's share price and hence, shareholders will not be worse off. However, this stance can be questioned for real life settings as payout policy allows for certain assumptions about the firm and its financial health.

  A firm that is distributing dividends is effectively lowering its potential cash position and hence its ability to respond to short-term cash needs. Furthermore, it is foregoing positive NPV investment projects that could be financed by internally generated resources. From a credit risk point of view, dividend payments could hence be seen critically.

  Nevertheless, this is only one part of the entire truth. The part still missing is shareholders' expectations and markets' assessment of a company not paying any dividends.

  In particular, stable and mature firms (also known as value stocks) are somewhat supposed to pay dividends. If management decides to drop dividend payments for a certain period, this will be perceived by markets as a sign of financial distress as they will accuse the firm of lacking the financial strength to payout to their shareholders. Subsequently, share prices will most certainly fall which leaves the company with a declining market capitalization.

  As we can see, there is a trade-off inherent in management's decision of how much earnings to distribute as dividends and how much to reinvest into the business. Again,

management needs to consider the company's current situation, its profile (whether it is rather perceived to be a value or growth stock) and any investment opportunities at hand. The rating scorecard for "Financial Policy" can be found in Appendix 10.

IV

Implications of Sector Characteristics on Model Variables

So far, we gave an overview of specific sector characteristics and introduced our own credit scoring model factor by factor. Now, we would like to match both components explaining the sector characteristics' impact on the assessment of each model factor and subsequently deriving factor weights which will determine the impact of the single variables on the aggregate credit risk assessment.

Weights for the new model were estimated by grouping Moody's individual industry rating models into the four industry sectors as defined previously. Since Banco Invest follows Moody's rating structure closely and the new credit rating model does not change in terms of the four main factors (Scale, Business Profile, Financial Profile and Financial Policy), we calculated averages across all individual industry rating models to obtain weights for those four main factors. These served as a first guideline. Since the new credit rating model changed significantly regarding sub-factors, we used our own reasoning to come up with a division of the single sub-factor weights. Eventually, we back-tested the weights we obtained by running our own credit rating model using company information of the Banco Invest company portfolio of previous years and comparing our rating results to those obtained by the bank applying the old model. We also tested for various defaulted Portuguese and Spanish companies whether our model was able to capture the default and adjusted weights whenever we deemed it necessary. After all, we obtained weights which on the one hand are close to Moody's average weights

when being summed up per factor, and on the other hand lead to persistent results when being compared to the Banco Invest ratings and can as well be explained by our reasoning for the relative importance for each sector credit risk model.

In the following, we will explain how variables that drive credit risk differ alongside specific industry characteristics. The explanations given per sector shall serve as a guideline, the credit analyst can readily refer back to when evaluating single companies.

IV.1 Services and Branded Products Sector

Distribution of factor weights for Services and Branded Products Sector:

Services and Branded Products		
Rating Factors	**Sub-Factors**	**Weighting**
Scale		**5%**
	Revenue	*5%*
Business Profile		**35%**
	Industry & Country Risk	
	Market Characteristics	*5%*
	Expected Growth	*4%*
	Exogenous Factors	*3%*
	Company Risk	
	Competitive Profile	*8%*
	Operating Efficiency	*4%*
	Geographic Diversification	*5%*
	Business Segments	6%
Financial Profile		**45%**
	Debt / EBITDA	*8%*
	EBITDA / Interest Expense	*8%*
	RCF / Net Debt	*12%*
	CFO / Debt	*12%*
	EBITDA Margin	*5%*
Financial Policy		**15%**
	Management Quality	*5%*
	Capital Structure	*4%*
	Liquidity & Payout Policy	*6%*

1.) Scale Factor (5%)

Most specific about the Services and Branded Products (SBP) sector is its direct interaction with the end-consumer market that represents the source of revenue generation. Quantities sold to markets will hence directly depend on saving and spending patterns prevalent in society. Furthermore, sales quantities will fluctuate with economic cycles according to product's dispensability in consumers' everyday life.

Prices and margins that can be realized during the sales process depend on a range of circumstances and conditions. Consumers' perceptions of a company's degree of innovation and market leadership impact the price premium that can be charged. A differentiating edge over competitors in the form of value-added product features that are unique to a single company will increase margins. On the contrary, limited ability to pass inflation in input prices on to end-consumers may squeeze margin profitability.

Moreover, companies that cover large market volumes may exercise power over suppliers and obtain price discounts for production inputs as well as operating cost reductions through economies of scale.

We assign a 5%-weight to this factor because revenue streams are reasonably stable, at least for non-discretionary products. For more volatile products, fluctuations should be fairly predictable by looking at indicators of future economic activity.

2.) Business Profile

Industry Risk (12%):

- *Market Characteristics 5%:* End-consumers determine the demand for the SBP sector. Consequently, demand moves alongside indicators that reflect their financial situation and spending power. Those are e.g. changes in household net worth, unemployment rate, level of salaries and level of disposable income. More intangible factors like consumer sentiment and trends may also play a role. Furthermore, dynamics in demand

are as well directly related to the nature of the product at hand. Non-discretionary, non-durable products tend to be least responsive to changes in the aforementioned factors, while discretionary, durable products show higher swings in demand.

- *Expected Growth 4%:* Expected growth rates are perceived to be rather stable and will converge into the overall GDP growth rate in the long-run. There may be phases of exceptional growth momentum for companies with outstanding, innovative products that perfectly satisfy consumer demand or even generate new demand that cannot be met by competitors. Apart from this, growth rates are also higher for emerging markets than developed market countries since the former are less saturated due to lower market penetration in the past and now catch up with the latter due to a pick-up in demand and population growth.
- *Exogenous Factors 3%:* Exogenous factors are of minor importance to the course of business for SBP companies. Important to mention are regulation and policies regarding the workforce like governments' and labour unions' impact on wages which will directly affect the level of operational cost. On the demand side, federal incentive programs can temporarily lead to jumps in demand while tax increases will dampen potential for revenue generation.

Company Risk (17%):

- *Competitive Profile 8%:* Succeeding in the "Competitive Profile" factor is more important for SBP companies than for all other sectors and has the potential to significantly impact financial performance stability and the corporate risk profile. In order to be able to capture price premiums, a SBP firm needs to capitalize on its brand equity. Strong brand equity is formed by brand reputation and recognition amongst customers which is directly connected to superior product quality, level of technological sophistication, design or user friendliness leading to customer satisfaction which is

surpassing the one for competitor products. A way to achieve customer satisfaction and brand reputation is continuous innovation driven by diligent market research and the early recognition of trends and tendencies. If a firm does not achieve to obtain a differentiating edge over competitors, the only way to remain in the market is offering lower prices. This observation results in two clearly separable business models for SBP companies, namely product differentiation and cost leadership, which need to be pursued consistently and communicated efficiently to the end-consumer to allow for easy orientation and effective purchase decisions. Another source of competitive advantage is a strong salesforce and a tight network of distribution channels which make products and services easily accessible and visible to end-consumers.

- *Operating Efficiency 4%:* Manufacturing and marketing products in a cost-efficient manner is undeniably important for SBP companies. A way which is often chosen nowadays to accomplish operating efficiency is outsourcing manufacturing processes and only performing R&D, marketing and control functions in-house. The rationale behind is that a major cost driver for SBP companies is labour cost which can be decreased by shifting operations to low-wage countries. Other than that, it has to be mentioned that expenditures in fixed assets are substantially lower for this sector than for others which leads to lower operational leverage and higher flexibility in cost adjustments due to a higher proportion of variable cost. We hence only assign a weight of 4% to this factor.
- *Geographic Diversification 5%:* Being geographically diversified in a sense that products are marketed to a range of geographic areas is of utmost importance for SBP companies. While the North American and Western European market are saturated with a vast product offering, emerging (Asian) markets are said to be the new revenue drivers due to their growing middle class and increases in disposable income. Apart from that,

extending business to different geographic areas increases volume which may help to obtain economies of scale, enhanced brand recognition and increased negotiating power with suppliers, all of which will ultimately result in entry barriers for competitors. However, firms need to keep in mind that consumers are different across regional markets due to differences in cultures and value perceptions. Hence, regional expertise and careful positioning on international markets is key to capture the benefits from geographic diversification.

- *Business Segment Diversification 6%:* As mentioned before, diversification will lead to an extension of SBP businesses which, if carried out thoroughly, can result in higher cash-flows and enhanced company performance. This does not only apply for geographic but also for business segment diversification. In segment diversification, a company multiplies the markets it is offering products to, thus capturing cross-selling potential, increasing presence and strengthening brand recognition. Segment diversification will reduce the exposure to adverse effects from regulation or volume contraction in one particular market area and offset them with new growth opportunities in another segment.

We have over-weighted the risk factors residing on the micro-level of the firm because we think that these factors are more decisive for financial stability than overall macro-economic conditions.

3.) Financial Profile

- *Debt/EBITDA 8%:* This leverage ratio determines the solvency of a company by setting debt in relation to operating income. SBP companies have lower funding needs in terms of re-investment into fixed operating asset than e.g. capital and asset-intensive industries. Here, the challenge resides more in the funding of current assets like

inventories and accounts payable. Hence, we consider this ratio important, but less relevant than cash-flow related metrics.

- *EBITDA/Interest Expense 8%:* EBITDA-to-interest expense evaluates the ability to service interest payments from operating income. Here again, the same reasoning applies as for the previous ratio. We consider it important in the assessment for SBP companies because solvency is the key for financial stability over the long-run. Nonetheless, solvency does not imply liquidity at any given moment; a company can encounter liquidity shortages given a healthy solvency situation. Hence, this ratio as well has a lower weight than the following cash-flow coverage ratios.
- *RCF/Net Debt 12%:* Retained cash flow-to net debt sets cash flow after paying for shareholder dividends and before changes in working capital and capex in relation to debt loadings. In this way, it indicates debt repayment capacity before the company makes any re-investments into the fixed or current asset base or takes on new investment projects. We consider this ratio as informative in the context of SBP companies and hence assign a weight of 12%.
- *CFO/Debt 12%:* Cash flow from operations-to-debt measures the proportion of cash flow after paying for shareholder dividends and changes in working capital to total debt loads. We consider this ratio very relevant for SBP companies because it allows for making assumptions about adjustments in the level of working capital that a company may carry out as a measure to increase debt repayment capacity. Proper working capital management is crucial for SBP companies since they maintain numerous relationships with suppliers and clients where cash circulates on a dynamic basis. If a SBP company encounters problems to service debt payments, it might adjust working capital levels by decreasing receivable or increasing payable levels to free-up more cash.

- *EBITDA Margin 5%:* EBITDA margin is an indicator of operational efficiency and sound cost management. Undoubtedly, this is an important aspect to consider for SBP firms, but is not a core driver of credit risk exposure, which makes us assign a weight of 5%.

4.) Financial Policy

- *Management Quality 5%:* Management's skill will be primarily challenged by the labour-intensity of SBP firms on the one hand and by the direct exposure to end-consumer markets on the other hand. Hence, running those businesses requires a lot of social competencies and the ability to empathize and communicate efficiently along all sides of the business.

  Furthermore, management needs to dispose of the flexibility necessary to reinvent the product portfolio, adjust variable parts of operations and react to emerging business opportunities anytime market conditions require it to do so.
- *Capital Structure 4%:* In comparison to other sectors, SBP industries are less capital intensive. Nevertheless, easily accessible sources of financing are important for these companies, too, since they can obtain competitive advantage and raise entry barriers for competitors when growing large.
- *Liquidity 6%:* SBP companies participate in a very fast-lived business environment, constantly being driven by the latest upcoming trends and consumer preferences. These conditions require SBP companies to take on business opportunities quickly as they emerge in order to avoid that their offering becomes outdated and obsolete. To be able to do so, there is the need of certain financial flexibility and capital buffers to be invested quickly. Hence, a good liquidity position can translate into a major competitive advantage for SBP companies.

Apart from that, another aspect worthwhile looking at in the context of liquidity is the cash conversion cycle. Since SBP companies interact with various suppliers on one end and numerous customers on the other end of the supply chain, they need to watch out for the time span they need to convert investments into cash-flows. Powerful SBP companies might carry this to a degree where they can extent their payables period to suppliers and hence even obtain a type of temporary cash credit which might allow them to take on additional business opportunities until they pay to suppliers.

IV.2 Capital or Asset-Intensive Industries Sector

Distribution of factor weights for Capital and Asset-Intensive Sector:

Capital and Asset Intensive		
Rating Factors	**Sub-Factors**	**Weighting**
Scale		**10%**
	Revenue	*10%*
Business Profile		**35%**
	Industry & Country Risk	
	Market Characteristics	*5%*
	Expected Growth	*5%*
	Exogenous Factors	*3%*
	Company Risk	
	Competitive Profile	*5%*
	Operating Efficiency	*7%*
	Geographic Diversification	*5%*
	Business Segments	5%
Financial Profile		**40%**
	Debt / EBITDA	*10%*
	EBITDA / Interest Expense	*8%*
	RCF / Net Debt	*7%*
	FCF / Debt	*7%*
	EBITDA Margin	*8%*
Financial Policy		**15%**
	Management Quality	*5%*
	Capital Structure	*6%*
	Liquidity & Payout Policy	*4%*

1.) ***Scale (10%)***

Scale as measured by business volume plays an important role for capital and asset-intensive (CAI) firms in determining their creditworthiness. It is directly related to volatility in the amount of sales and the pricing of the products offered.

For CAI companies, fluctuation in revenues is mainly bound to general economic conditions. Growth or decline in GDP, trade volumes and per capita wealth directly influence revenue streams that companies can realize. Length and depth of economic cycles may vary by product though with some being more reactive than others, mainly depending on how essential goods are to consumers. A common way to smooth out revenue streams is generating order backlogs instead of temporarily adjusting production capacity which is costly and might lie idle in times of market downturns.

Prices from the sale of products underlie the price setting power of the respective firm. Whenever a firm has a portfolio of innovative products that are based on disruptive production techniques or protected by patents and thus hard to copy, it may charge a price premium. On the contrary, companies who offer generic products will try to attract customers by low prices which will squeeze margins.

2.) Business Profile

Industry Risk (13%):

- *Market Characteristics 5%:* Demand for products of CAI industries depend on the characteristics of the product portfolio. Product portfolios typically run through a lifecycle with high demand in initiation phases when products are perceived to be innovative and no substitutes are available on markets. Products then gradually mature with demand declining over time until they become obsolete and are replaced by new product versions. The longer a product lifecycle, the more stable demand for a company

will be. If a firm has certain blockbuster products in its portfolio, they can cover the major part of overall demand.

- *Expected growth 5%:* Industry growth is mainly aligned with overall GDP growth. Some firms may realize exceptional growth due to product innovation and patents which allow them to over-proportionally capture market share. On the downside, growth may be dampened by patent expiration and cannibalism effects from substitute products of competitors.
- *Exogenous Factors 3%:* Exogenous factors play a minor role for the CAI industry. Government regulation considering safety standards of products and production techniques should still be mentioned. However, they are mainly foreseeable and should hence not impact corporate creditworthiness to a large extent.

Company Risk (17%):

- *Competitive Profile 5%:* Companies acting within the CAI industry do not differentiate themselves too much along factors like brand identity or marketing campaigns. What really sets one company apart from the other is product quality, degree of innovation, technological advance and superior production expertise. Companies who do not dispose of any of these competitive advantages will only remain in markets by offering a better price than competitors which at the same time stresses margins and forces them to operate extremely cost-efficient.
- *Operating efficiency 7%:* Operating efficiency is of utmost importance for companies of the CAI industry in light of the considerable level of cost that they incur in order to be able to operate. Namely, there are high expenses in R&D which guarantee a constant flow of innovation and technological progress. Furthermore, as the name of this industry suggests, it is characterized by substantial spending on fixed production assets, be it for purchase of plants, machinery and equipment or their subsequent maintenance and

refurbishment. In this context, CAI companies need to realize economies of scale and scope, to spread fixed cost across higher production volumes. The bigger these companies grow or the stronger their position is for the production of one particular product, the easier economies of scale are to be obtained. Companies not being able to manufacture and distribute cost-efficiently will the sooner or later not be able to service high loads of fixed cost that the nature of their business implies.

Another aspect to be mentioned is CAI firms' dependence on input prices from raw materials. Operational efficiency will also depend on their ability to pass increases in raw material prices on to end consumers. Due to the high importance of operational efficiency in several perspectives, we assign a weight of 7%.

- *Geographic Diversification 5%:* For CAI businesses, geographic diversification is an important means of lowering potential risks. Being present in different international markets diversifies the origins of the customer base which may smooth out fluctuation in revenue (e.g. downturn in product demand in North America and Western Europe is off-set with rising demand from emerging market countries). Nevertheless, there is also a certain downside potential stemming from geographic diversification: there may be currency mismatches between production countries where costs are incurred and target market countries where products are sold to.
- *Business Segment Diversification 5%:* Business segment diversification is beneficial for CAI companies as it reduces dependency on revenue streams from one single product type. A company may suddenly lose market share in one product segment because competitors managed to creating entry barriers through large capital expenditures in enhanced machinery or through application of patents after successful completion of R&D processes. Being diversified across segments might mitigate the risk of being caught by these scenarios. On the downside, diversifying across various capital-

intensive business segments once again raises funding requirements and subsequent interest down-payments. Hence, benefits should be weighted carefully against additional cost arising from it.

3.) Financial Profile

- *Debt/EBITDA 10%:* CAI companies require a lot of capital to fund their operations. It is hence indicative of their financial stability to look at a leverage ratio like Debt/EBITDA in order to get a sense of the proportion of debt funding to operating income which is used to finance debt loads.
- *EBITDA/Interest Expense 8%:* This coverage ratio reveals the relation of operational income before non-cash expenses for depreciation and amortization to interest expenses that have been incurred to finance operations. It is worthwhile looking at for CAI companies due to their high capital requirements. Using EBITDA instead of EBIT is considered useful in credit analysis to avoid distortions in the assessment of debt repayment capacity since depreciation and amortization do not represent any real cash outflows.
- *RCF/Net Debt 7%:* Retained cash flow adds back capital expenditures and changes in working capital to free-cash flow and hence reveals how much proceeds from operations a company has left to service debt payments. It is useful for the assessment of CAI companies, since it allows for judging corporate solvency before any investments in fixed assets are made and keeps this term flexible with regard to credit risk exposure. If the company perceives the ratio to be at a critical level, it may defer expenditures in fixed assets to the next period to retain more cash for debt repayment.
- *FCF/Net Debt 7%:* Free cash flow is calculated as operating cash flow less capital expenditures which are incurred to expand or maintain the asset base. In relation to net debt, it indicates the ratio between the remainder of cash that is free to be paid to

investors and the total debt amount raised by the company. It is informative for CAI industries since capital expenditures which make up the difference between operating and free cash flow are substantial.

- *EBITDA Margin 8%:* EBITDA margin is meaningful in determining how efficient a company is in cutting down operational cost and realizing economies of scale. As described in the "Business Profile" factor, operational efficiency is highly important for CAI companies and decisive for their level of financial stability. Hence, EBITDA margin appears as a useful metric to measure the level of accomplishment of this factor and therefore carries a weight of 8%.

4.) Financial Policy

- *Management Quality 5%:* The primary challenge for management of CAI companies is dealing with their capital intensity. Management has to be able to decide upon the amount and timing of investments into the fixed asset base and to judge which expansion projects to take on and which ones to forego. Oftentimes, these decisions are complex and require a lot of industry-specific knowledge and expertise.

  Moreover, management constantly has to be vigilant about the cost efficiency of operation processes and needs to find ways how to further cut down cost and increase economies of scale without compromising product quality.

- *Capital Structure 6%:* Apart from cost-efficient operations, decisions considering sources of financing are as well important to ensure a sustainable solvency situation at all times. Because of their capital intensity, CAI firms should dispose of easy access to either debt or equity capital markets at reasonable cost. For the debt portion in CAI firms' capital structure, special caution has to be exercised with regard to interest payments due to the volatility present in revenue streams and profitability margins which may affect timely fulfilment of these obligations.

- *Liquidity 4%:* Having considered capital intensity as a driver of credit risk in the previous factors, there are also instances in which it can be helpful. If a firm is in extreme financial distress, it can opt for liquidation of a part of its asset base to raise the level of cash which is available to service debt payments. Companies with a large asset base can do this with ease whereas companies that primarily rely on intangible inputs for their operations struggle to do so.

  Apart from that, aspects of liquidity that matter for CAI firms are an adequate cash conversion circle as well as a decent cash buffer for interest payments that come due in the near-term future.

  Since we perceive the biggest impact on credit risk stemming from capital intensity and the resultant level of leverage, we assign a 6% weight to “Capital Structure” and a 4% weight to “Liquidity”.

IV.3 Pure Commodity Industries Sector

Distribution of factor weights for Pure Commodity Industries Sector:

Pure Commodity		
Rating Factors	**Sub-Factors**	**Weighting**
Scale		**10%**
	Revenue	*10%*
Business Profile		**35%**
	Industry & Country Risk	
	Market Characteristics	*6%*
	Expected Growth	*3%*
	Exogenous Factors	*5%*
	Company Risk	
	Competitive Profile	*4%*
	Operating Efficiency	*7%*
	Geographic Diversification	*4%*
	Business Segments	6%
Financial Profile		**40%**
	Debt / EBITDA	*10%*
	EBITDA / Interest Expense	*9%*
	RCF / Net Debt	*7%*
	FCF / Debt	*6%*
	EBITDA Margin	*8%*
Financial Policy		**15%**
	Management Quality	*4%*
	Capital Structure	*6%*
	Liquidity & Payout Policy	*5%*

1.) Scale Factor (10%)

Scale assesses the impact of a commodity firm's business volume on its exposure to credit risk. The scale of corporate revenues is determined by the quantity of sales and by prices that can be charged from customers. Commodity firms are subject to volatility in sales volumes which is due to both, seasonal ups and downs on the short-run and co-movement with the general economic cycle on the long-run. This can be explained by the fact that commodity goods represent primary inputs for manufacturing and production industries and hence depend on

volume contractions and expansions in those markets which also typically move alongside overall macroeconomic conditions.

Prices as well tend to be volatile, mainly because of competitive price pressures on the one hand and sudden, unexpected supply shortages on the other hand. The latter happens whenever exogenous factors like e.g. natural impacts (droughts, diseases) or government regulation (trade restrictions) decreases the amount of commodity goods traded in markets. Prices will subsequently jump for a short period of time until customers will walk away to substitute products. The presence of volatility in both, sales volumes and prices, makes us assign a 10% weight to the scale factor as we would like to account for the instability of revenue streams and the resulting impact on credit risk exposure.

2.) Business Profile

Industry Risk (18%):

- *Market Characteristics 6%:* Demand in commodity markets tends to be very cyclical and is mainly driven by the overall state of industries which use commodities as raw material input for production. Pure commodity firms which are particularly prone to cyclical fluctuation are the ones delivering raw materials to the construction industry. Producers of fossil fuels like crude oil will as well notice changes in the state of the global economy since their product is input to almost all (energy-consuming) manufacturing processes. On the opposite, food-producing commodity firms see less cyclicality in demand because they provide production inputs for non-discretionary products which will also be consumed in times of recession.
- *Expected Growth 3%:* Opportunities for growth are limited on the single company level, at least in the short-run. This is due to the high price pressure which depresses margins and profitability. Furthermore, it is difficult for one company to stand out from the

others because differentiation potential is limited. As a consequence, firms will grow alongside overall economic growth and barely surpass this benchmark.

- *Exogenous Factors 6%:* There is a range of factors that can impact commodity firms' operations and cash flows which lie beyond their scope of influence. These factors can either have a natural origin like droughts, floods or storms, all of them being able to diminish harvest or destroy natural resources that can be offered on markets. Alternatively, they can be rooted in politics, like e.g. trade restrictions or environmental regulations, both having the potential to affect revenue streams and operational cost. We assign a 5% weight to this factor to reflect its high-risk impact on firm's financial health and creditworthiness.

Company Risk (14%):

- *Competitive Profile 3%:* As their name suggests, commodity businesses provide commoditized goods which are characterized by their low potential to be differentiated from one another. As a result, firms have very little scope to retain clients other than by providing the cheapest price possible. If they try to offer their goods at a premium, clients will switch to competitors as the perceived quality of the product does not differ across suppliers. Marketing or branding efforts do not create any value added since they are not considered important for commodity goods by the average customer and will hence not lead to higher switching cost.
- *Operational Efficiency 7%:* Operational efficiency is of great importance for commodity firms since their only measure to increase margins is proper cost management. Optimal capacity utilization and economies of scale are two ways how operational efficiency can be improved. If a commodity firm is good at realizing economies of scale, it might grow large and consequently gains competitive advantage and drives competitors out of the market. Disposing of good vertical integration is

another factor which may add to operational efficiency. Vertical integration is the extent to which a commodity firm is linked with its successors in the supply chain. For example, strategic geographic positioning in close reach to manufacturers cuts down distribution cost and creates advantages over competitors from outside the region. Since operational efficiency is the only real lever a commodity firm has at hand to increase margins and create entry barriers, we assign a weight of 7% to this factor.

- *Geographic Diversification 4%:* For commodity firms, we see geographic diversification as being closely interrelated with exogenous factors as diversifying across countries reduces the risk of being caught adversely by one of the events described in this model factor. Hence, a commodity form which operates in different countries may be better off in comparison to a business which concentrates operations to one single market. Nonetheless, geographic diversification also introduces riskiness of operations and business processes, which is especially true for commodity firms because their operations frequently take place on emerging market countries.
- *Business Segment Diversification 6%:* Here again, diversifying across different commodities segments might limit adverse effects from exogenous factors. In addition to that, business segment diversification can also increase product differentiation and vertical integration every time a commodity firm accomplishes to offer value-added products or services which would actually belong to the product range of aftermarket business segments. Adding features to their product offering may lead to higher pricing power, enhanced client retention rates and a competitive advantage over competitors. Due to this opportunity of mutually lowering risk and differentiating business profiles, we assign a weight of 6%to business segment diversification.

All in all, we see credit risk for commodity firms to be driven more by market-wide than by firm-specific conditions and hence over-weight the first factor.

3.) Financial Profile

- *Debt/EBITDA 10%:* Commodity firms' business model brings along a lot of funding requirements for machinery, plants and production sites. As a result, businesses are usually highly levered. A leverage ratio like debt-to-EBITDA should thus be followed closely to get a sense of the firm's ability to service debt payments by what it generates through operations. This is particularly the case as revenue streams have the potential to fluctuate substantially over time, introducing riskiness to the debt service capacity.
- *EBITDA/Interest Expense 9%:* As described earlier, cost management is essential to secure income from operations as there is little possibility to adjust prices. Interest expenses will then be paid for from what is left of proceeds from operations. EBITDA coverage ratio transmits a good picture of a firm's efficiency in doing so. EBITDA is preferred over EBIT since non-cash expenses for commodity firms are essential and their exclusion might lead to a distorted picture of a firm's ability to pay for its debt.
- *RCF/Net Debt 7%:* Retained cash-flow as cash-flow before changes in working capital and capital expenditures delivers a good indicator of the firm's initial position before making any investment decisions. Being set in relation to debt, it is indicative of commodity firms' ability to service interest payments before making re-investment into property, plants and equipment which is substantial in this sector. It is helpful in drawing conclusions about whether investments into the asset base can be carried out without putting the firm at risk of financial instability or whether they should rather be deferred to another point in time.
- *FCF/Debt 6%:* Free cash-flow which is operating cash-flow less capital expenditures reveals how much money is essentially left on the table to pay for debt obligations. Relative to total debt, it delivers an immediate impression of a firm's financial health.

- *EBITDA Margin 8%:* EBITDA margin indicates very well how efficient a firm manages its operating cost. Since this aspect is crucial in the context of commodity firms, this ratio has high informative value for the financial soundness of commodity firms and counts with a weight of 8%.

4.) Financial Policy

- *Management Quality 4%:* As previously mentioned, there is little potential for product differentiation in the pure commodity sector. Going one step further, this can be exactly seen as the point where management quality kicks in. Where product features do not create switching cost, long-tenured, strong supply relationships with manufacturers can even more do so. Furthermore, prudent cost management just as coping with volatility in sales volumes and prices require a lot of executive skill.
- *Capital Structure 6%:* Commodity businesses are highly capital-intensive. Initial outlays to start operations are huge and reinvestment into fixed assets is substantial. In the majority of cases, these conditions require funding raised from debt capital markets and banks. In combination with high volatility in revenue streams and stressed profitability due to low margins, this may create risks in the context of corporate solvency. Hence, commodity firms need to be considerate about the relation of what they own to what they owe not to surpass the limit where they are no longer able to service the payments arising from their debt loads. Debt investor's risk of investing in commodity firm's securities is however oftentimes limited as they are backed by the vast asset base which serves as collateral.
- *Liquidity Management 5%:* Here again, it needs to me mentioned that commodity firms are subject to sudden fluctuations in business volumes and prices that they might not foresee. Disposing of a comfortable liquidity cushion seems to be a reasonable measure to answer to these challenges, also in light of the fact that most commodity firms count

with substantial interest payments that they have to service, no matter if revenues are flowing in the current period, or not.

Furthermore, a balance sheet caption that has to be closely followed is accounts receivables since commodity firms have only limited ability to off-set them with account payables due to their positioning in the supply chain (they deliver goods to a lot of customers but barely purchase inputs where they could delay payment). Commodity firms should consequently try to keep their cash conversion cycle as short as possible.

IV.4 National Industries & Utilities Sector

Distribution of factor weights for National Industries & Utilities Sector:

National Industries & Utilities		
Rating Factors	**Sub-Factors**	**Weighting**
Scale		**5%**
	Revenues	*5%*
Business Profile		**35%**
	Industry Risk	
	Market Characteristics	*4%*
	Expected Growth	*4%*
	Exogenous Factors	*8%*
	Company Risk	
	Competitive Profile	*4%*
	Operating Efficiency	*8%*
	Geographic Diversification	*3%*
	Business Segments	*4%*
Financial Profile		**45%**
	Debt / EBITDA	*13%*
	EBITDA / Interest Expense	*11%*
	RCF / Net Debt	*8%*
	FCF / Debt	*7%*
	EBITDA Margin	*6%*
Financial Policy		**15%**
	Management Quality	*5%*
	Capital Structure	*6%*
	Liquidity & Payout Policy	*4%*

1.) *Scale Factor (5%)*

The first model factor "Scale" is intended to assess the credit strength of an entity according to its business volume as measured by revenue. National industries and utilities (NI&U) provide infrastructure services which are goods of everyday use that are essential to the society as a whole. As a result, this sector's customer base is broad by definition. Furthermore, NI&U act under government regulation which oftentimes enables them to position themselves as predominant force in entire markets and protects them from competitors who might take over market share. Considering the price setting process, NI&U have high pricing power due to their monopoly-like status. Governments frequently influence the price setting process by determining tariffs that need to be charged from customers. Overall, these conditions lead to mostly reliable revenue streams for the NI&U sector. We hence assign a weight of 5% to reflect a limited impact stemming from the scale factor onto the overall credit risk exposure.

1.) Business Profile

Industry Risk (16%):

- *Market Characteristics 4%:* Demand for NI&U's infrastructure services is reasonably stable due to their positioning as non-discretionary goods. It is not subject to cyclicality meaning that it is resistant to economic cycles and exhibits low price elasticity. Consequently, this factor feeds into the overall rating assignment at a weight of 4%.
- *Expected Growth 4%:* NI&U companies are said to have limited growth potential at least in the short-run. Growth is mainly determined by a change in size of the customer base (e.g. through demographics or fluctuations on housing markets). Another indicator might be GDP growth as a measure of overall economic activity which allows for drawing conclusions about the general need for infrastructure services.
- *Exogenous Factors 8%:* The NI&U sector is heavily influenced by exogenous factors, namely government interventions, regulatory regimes, tariffs and taxation. Companies

are not able to shape these impacts, they can only anticipate and react to new rules imposed on them. Their ability to cope with regulation and policies has a high impact on their solvency and liquidity situation. To give an example, they might be required to fulfill environmentally motivated operating restrictions which oftentimes come at high investment requirements in order to be met. Due to exogenous factors' potential to affect the financial situation of a firm substantially, we assign a weight of 8%.

- *Competitive Profile 4%:* NI&U companies have limited capacity to differentiate themselves from competitors due to the nature of goods and services they provide. Brand strength and marketing efforts have a minor role in their business models. At the same time, there is also no real need for concerns about this factor since NI&U companies are broadly shielded from other firms accessing the market because of government regulation. Henceforth, we assign a weight of 4%.
- *Operating Efficiency 8%:* Efficient operations are of great importance to NI&U firms. They need to be in control of their operating cost because of their limited power to adjust prices on the one hand and because of their capital intensity and high leverage on the other hand. The latter will require them to make substantial expenditures for maintenance and expansion of their asset base as well as for the fulfillment of interest expenses. A weight of 8% proved to be adequate to account for the importance of operating efficiency for this sector.
- *Geographic Diversification 3%:* NI&U companies do not count with any geographic diversification by nature of their business. In most cases, they act amid the influence of a municipality's political and regulatory impact and serve local markets. It is hence the risk assessment for one single location and the lack of geographic diversification opportunities that will translate into a rating for this factor which obtains a weight of 3%.

- *Business Segment Diversification 4%:* Just as geographic diversification, business segment diversification tends to be limited to non-existent for NI&U companies. This can translate into increased riskiness for a business given that unfavourable conditions in one segment cannot be offset with benefits from another one.

2.) Financial Profile

- *Debt/EBITDA 13%:* One decisive feature of NI&U companies is their high level of leverage. They require high level of debt financing to fund capital expenditures their business models impose on them. Debt/EBITDA as a leverage ratio is thus an important ratio to get a sense of what the proportion of fixed claims on the company is in relation to the proceeds it generated by its operations, non-cash expenses still being included.
- *EBITDA/interest expense 11%:* This coverage ratio allows for an assessment of the company's ability to service interest payments by what it generates through operations. The better the cost management the company has in place, the more will be left over to fulfill interest payments.
- *RCF/Net Debt 8%:* Retained cash flow is the residual available to be invested into the asset base and new projects or to be maintained as a buffer for future payment of obligations. Being set into relation with net debt, it is a good indicator of overall financial health for the near-term future.
- *FCF/Debt 7%:* Free cash-flow as operating cash flow less capital investments into fixed assets and cash flow to fund financing reflects the cash that remains to be pay for interest obligations and to reduce debt loads.
- *EBITDA margin 6%:* EBITDA margin accounts for the ability to manage cost and realize economies of scale, both of which will ultimately turn into higher margins. As explained before, these are crucial considerations for NI&U companies, due to their limited pricing power.

Generally, we perceive solvency measures being orientated at capturing the firm's ability to deal with its level of leverage over the longer-term future to be more relevant for the assessment of financial soundness of NI&U firms than short-term cash flow coverage ratios. The rationale behind is that governments will back up NI&U firms with new capital injections given a sudden liquidity shortage. They effectively act as an insurance against credit risk exposure on the short-run. Consequently, the first two ratios impact the rating assessment at a higher weight than the second two ratios.

3.) Financial Policy

- *Management Quality 5%:* Management's skill and prudence is key for NI&U firms. They need to be able to handle investment in capital assets, high leverage levels and the need for effective cost management on the operating level. On top of that, they encounter frequent interaction and intervention by government and regulators who they need to maintain good relations with.
- *Capital Structure 6%:* As already mentioned, NI&U companies rely on debt financing as a major part of their funding sources. They hence do not dispose of the flexibility that equity financing provides in terms of investor compensation but they need to be able to pay for interest expenses in a timely manner. Nevertheless, their risk exposure is limited in a sense that the government will back up NI&U companies in case they cannot meet interest obligations.
- *Liquidity 4%:* NI&U companies need a reliable liquidity buffer to pay for their substantial interest obligations which come due on a regular basis. Relatively stable revenues do favour the availability of cash. However, NI&U firms are expected to make regular dividend payouts to shareholders which effectively lowers the level of cash retained in the company. The rationale behind is that stocks of utility firms are broadly perceived to be value investments by equity investors. Reluctance or inability of NI&U

firms to pay out dividends might discourage them to keep their funds invested which consequently again shifts the capital structure more to debt financing.

V

Model Test for Active & Defaulted companies

In order to test the new model on precision and consistency of results, we took eight companies of Banco Invest's portfolio and four companies that defaulted in the Iberian market in the last 10 years. Selection criteria for the defaulted companies were comparability to the active companies in terms of business profile and assignability to one of the four industry sectors. The final test sample is as follows:

Pure Commodity Sector:

- *Sovena Oilseed Portugal:* Subsidiary of Sovena Group; refines, produces and distributes vegetable and olive oil internationally.
- *Galp Energía*: Portuguese company comprising business activities in the natural gas and petroleum supply, exploration, production, regasification, transportation, storage, and distribution sector.
- *SA Hullera Vasco Leonesa*: It was a Spanish coal mining company that was founded in 1893 and defaulted in 2014. It operated in the metal and mining industry.

***National Industries & Utilities Sector*:**

- *Electricidade dos Açores*: Electric utilities company belonging to the National Industries and Utilities sector that operates on the Azores islands.
- *Empresa de Electricidade da Madeira*: Portuguese electric energy utilities company founded in 1974.

- *Autopista de la Costa Cálida*: the company was constituted in 2004 and filed for bankruptcy in 2012. It was responsible for construction and maintenance of the highway that connects the Spanish regions of Andalucía and Murcia.

***Capital and Asset*-intensive Industries Sector:**

- *Hovione Farmaciencia*: Pharmaceutical company which is headquartered in Portugal and operates worldwide.
- *COLEP Portugal*: Leading Portuguese player in the global consumer goods packaging and contract manufacturing industry.
- *Islas Airways*: Was an airline based in Tenerife that offered passenger transportation services around the Canary Islands. It was founded in 2002 and defaulted in 2011.

***Services and Branded Products Industries Sector*:**

- *Jerónimo Martins*: Portuguese group operating in the business and consumer services industry with leadership positions in the retailer market in Portugal and Poland.
- *Dufry AG*: Swiss-based travel retailer that operates duty-free shops in airports located in more than 64 countries worldwide.
- *Imtech Spain Sociedad Limitada:* Offered software technology services to different companies in the industrial sector; started operations in 2001 and went bankrupt in January 2017.

The purpose of the test is to demonstrate that our rating model is able to capture credit risk exposure at least as precisely as the initial Banco Invest model. To prove this statement, we estimated rating scores for all of the abovementioned companies using our own model as well as the original Banco Invest model. We repeated this procedure for the last three years of available company data to control for deviations attributable to non-recurring events. Comparing both models' results allows us to look into possible origins of divergences.

Our evaluation criteria for the quality and precision of the new model were 1) to obtain ratings for the bankrupted companies that fall into a rating notch that reflects proximity to default; 2) to derive ratings for the defaulted companies that were equal to slightly lower than the Banco Invest ratings to confirm that our model returns prudent and rather conservative rating scores and does not underestimate default risk; 3) to obtain ratings for active companies that were as close as possible to Banco Invest's scores.

Whenever there was a lack of information to carry out the qualitative analysis required in the "Business Profile" factor, we have transmitted the rating score of the previous to the following period. This was especially the case for the defaulted companies because little information had been published in the year of their bankruptcies. For the "Financial Policy" factor, we decided to assign a fixed rating score of 3 whenever information was completely absent. Nonetheless, we do not consider this adjustments to largely affect the rating outcomes since qualitative factor assessments tend to be rather static in the short-run and influenced by the company's business activities of immediately preceding years.

After conducting the factor assessment and subsequent match with the adequate rating notch on the respective scorecards, we discussed the resulting ratings with all the group members in order to reduce subjectivity of the assessment.

V.1 Test Outcomes

When utilized in the tests, the new model showed a good rating results across all sectors. It met our criteria of being slightly lower than Banco Invests' rating scores for the defaulted companies and therefore confirms an adequate level of prudency and conservatism for our assessment approach. For the active companies, our model revealed to work out better for some sectors than for others. In the majority of cases we obtain rating scores close to the ones

of Banco Invest which we deem as an indicator for its practicability. In the following, we will compare rating outcomes sector by sector.

For the pure commodity sector test of the defaulted company, Banco Invest's model returns higher rating scores than the new model in all of the three years analysed. The maximum difference between the two models is 0.69 for the defaulted company. The difference can be traced back to the Business Profile factor, where the values of market share (7) and technology position (7) in the original model are considerably higher. We account for them in a different way in our model because we focus more on the effect of operational efficiency (5) which does not yield good results for the tested company. Moreover, there is a gap of 0.64 in the Financial Profile factor, which is explained by the different allocation of weights for each ratio and the definition of a sector specific scorecard table.

Likewise, in case of non-defaulted companies, the bank model returned higher rating scores for each year with a maximum difference of 0.41 for Galp Energia, in the first year, and 0.47 for Sovena Oilseeds Portugal S.A. in the third year. At first sight, the new model seems to overestimate credit risk exposure in case of Galp Energia, while there is little evidence in Sovena Oilseeds Portugal. Nevertheless, it has to be taken into account that deviations may come from subjectivity in the assessment of the qualitative factors and that testing three companies may not pose a representative data sample after all.

Company	Model	Y	Y-1	Y-2
Pure Commodity Macro Sector				
Galp Energia	Banco Invest	7.00	6.60	6.20
	Nova SBE	6.59	6.25	5.93
	Difference	**0.41**	**0.35**	**0.27**
SA Hullera Vasco Leonessa	Banco Invest	3.35	3.35	6.80
	Nova SBE	3.15	3.27	6.11
	Difference	**0.20**	**0.08**	**0.69**
Sovena Oilseeds Portugal S.A.	Banco Invest	6.30	6.65	6.25
	Nova SBE	6.13	6.49	5.78
	Difference	**0.17**	**0.16**	**0.47**

With regard to the Capital and Asset-Intensive sector model, the spread between model outcomes for active companies tends to be slightly higher for Hovione Farmaciencia, with a maximum difference of 0.58, and smaller for Colep with a maximum difference of 0.28. For Hovione, the difference is explained by the financial profile rating (3.53 for our model and 4.5 for Banco Invest) and by the effect of the 10%-weight for the Scale factor that is only rated at a score of 3. For Colep, the origins of divergence were the same. However, we think that weighting the Scale-factor at 10% is well justified by our industry analysis and henceforth, we did not opt for changing it.

Considering the test of the defaulted company, the new model again returns the lowest rating score amongst the three companies tested with a maximum difference of 0.56 three years before bankruptcy. The difference is equally distributed between the business profile (2.10 of Banco Invest versus 1.81) and financial profile (0.98 of the proposal model against the 1.40 of the bank's).

Company	Model	Y	Y-1	Y-2
Capital or Asset Intensive Macro Sector				
Hovione Farmaciencia SA	Banco Invest	8.05	8.05	7.55
	Nova SBE	7.47	7.54	7.40
	Difference	**0.58**	**0.51**	**0.15**
Islas Airways	Banco Invest	3.65	3.85	4.00
	Nova SBE	3.20	3.71	3.44
	Difference	**0.45**	**0.14**	**0.56**
Colep Portugal SA	Banco Invest	6.45	6.10	6.25
	Nova SBE	6.40	5.86	5.97
	Difference	**0.05**	**0.24**	**0.28**

When testing Services and Branded Products industries, we obtained good results for the new model. It returned very close results in one non-defaulted company and a lower rating for the bankrupted company. While for Dufry, both of the models obtained more or less the same

rating, for Jeronimo Martins the original model constantly delivered higher ratings with a maximum difference of 0.37. This time the divergence can only be traced back to differences in the assessment of profitability while for all other factors, we obtained the same rating values as Banco Invest.

Differences in ratings for Imtech Spain are pretty consistent, with a maximum difference of 0.32 and a minimum difference of 0.27. According to the new model, the company obtains low ratings in Business Segment (5) and Operating Efficiency (5), variables that the previous model does not take into account in the same way. Considering the rating outcomes, our new model would lead to a slight downgrade in ratings and could hence overstate default risk.

Company	Model	Y	Y-1	Y-2
Services & Branded Products Macro Sector				
Jerònimo Martins SGPS	Banco Invest	8.90	8.90	8.75
	Nova SBE	8.65	8.53	8.53
	Difference	**0.25**	**0.37**	**0.22**
Imtech Spain Sociedad Limitada	Banco Invest	3.75	3.75	3.80
	Nova SBE	3.43	3.43	3.53
	Difference	**0.32**	**0.32**	**0.27**
Dufry AG	Banco Invest	6.65	6.45	6.6
	Nova SBE	6.66	6.58	6.66
	Difference	**-0.01**	**-0.13**	**-0.06**

For the National Industries and Utilities sector, the picture is different: we obtain remarkably higher ratings with the new model than with Banco Invest's original model. The reason might lie in the new weights and the scorecards that were adjusted for the Business Profile and Financial Profile factor. In particular, we describe the effects of exogenous factors, leverage, financial coverage and profitability in closer detail as when compared to Banco Invests model. It could be that in this way, our model is more able to account for beneficial effects from the

monopoly-like status of this industry, the option for government aid in times of financial distress and relative price stability.

Surprisingly, this result is not confirmed for the assessment of the defaulted company. In contrast, our model delivers more prudent ratings here, reflecting a higher probability of default. In conjunction, this could be seen as evidence that our model is able to capture financial distress whenever it is present, but is also not too restrictive for companies that are financially sound.

Company	Model	Y	Y-1	Y-2
National Industries & Utilities Macro Sector				
Eletricidade Dos Acores SA	Banco Invest	6.75	6.6	6.2
	Nova SBE	7.26	7.18	7.18
	Difference	**-0.51**	**-0.58**	**-0.98**
Autopista De La Costa Calida	Banco Invest	3.25	3.25	3.75
	Nova SBE	2.99	2.99	3.90
	Difference	**0.26**	**0.26**	**-0.15**
Empresa de electricidade da Madeira	Banco Invest	5.65	5.7	5.55
	Nova SBE	6.35	6.51	6.45
	Difference	**-0.70**	**-0.81**	**-0.90**

In conclusion, the previous tests show three main aspects: 1) no apparent evidence of over- or underestimation of credit risk, or at least not persistent along the sector models; 2) in most of the cases, the model complies with our self-imposed quality criteria obtaining lower ratings for defaulted companies and close values for active companies when compared to Banco Invest's results and 3) the new credit risk model seems to fit better for some sectors than others.

Nonetheless, as previously mentioned, these tests were performed under various restrictions and assumptions. In order to obtain more representative results, it seems recommendable to repeat the tests with a bigger company sample in order to adjust and reduce the distortion effect caused by the assumptions.

VI

Probability of Default Assessment

After having introduced our own credit rating model, we would now like to turn to the presentation of several statistical approaches for the estimation of probability of default measures (PD). Credit rating models deliver implied PD which are derived from observing historical defaults that actually occurred across the pool of rated companies. Nevertheless, economic research has come up with many alternatives to mathematically determine the PD. Namely there are linear regression models, discriminant analysis models, logit and probit models, neural networks and classification trees.

The main motivation behind the application of mathematical approaches is twofold: obviously, there is an urge to determine the probability of default as reliably as possible in order to avoid conceding credit to "bad debtors". Mathematically motivated models may do better in this context than credit rating models because they are purely objective based on numbers. They leave out every subjectivity stemming from human assessment which credit rating models rely on a lot as we have seen with the two models discussed earlier. The second reason is that credit rating agencies tend to focus on large, publicly traded corporations. Hence, the need has been arising to create PD models that are able to also rate small to medium-sized, non-public companies which are not followed by CRAs.

We will present two models in closer detail, Altman's Z-Score and a logistic regression model. We chose these models because they are perfectly suitable for the company set at hand and lie within the range of computations that we can perform. Commonly used approaches that we could not apply was Moody's KMV model which uses proprietary data to match the so-called distance-to-default with PD. Referring back to observable market prices of credit default swaps, bonds and options to derive the implied PD was also not possible for the entire company set

since a lot of the companies are not publicly listed. Hence, we have limited ourselves to Z-score and logistic regression models which we will describe in the following.

VI.1 Altman's Z-score

The first credit scoring model of its kind was developed by NYU professor Edward Altman in 1968. It was based on a sample of 66 traded U.S. manufacturing companies which all filed for Chapter 7 bankruptcy according to U.S. federal law. Altman matched these companies with survivor firms that coincided in terms of industry and size in order to prevent the model from delivering biased results. He subsequently applied a statistical method called discriminant analysis which led to the linear combination of four or five common financial ratios and a threshold value (so-called Z-score). The concept of discriminant analysis was developed by Fisher (1936) and aims at predicting one categorical dependent variable through the use of one or more independent variables.

The ratios are determined in a way that they minimize type I and type II errors in loan decisions. A type I error occurs when a loan is conceded to a bad debtor; a type II error consists in denying credit to a good debtor. The variables selected for the original Z-score model were:

- working capital / total assets (measures changes in current assets in relation to company size; for distressed firm this ratio typically turns negative, as current liabilities surpass current assets)
- retained earnings / total assets (measure of cumulative profitability summing up all earnings that were reinvested into the company and sets them in relation to assets used to generate them)
- EBIT / total assets (measures operating efficiency and productivity ignoring effects from taxes and financing decisions; the higher the ratio, the higher productivity)

- market value of equity / book value of total liabilities (measures the relationship between what a firm owns to what it owes)
- sales / total assets (measures the efficiency of a firm in using its assets to generate revenues; the higher the ratio, the more competitive the firm)

The original coefficients Altman found through use of discriminant analysis were:

$$Z = 1.2\,X_1 + 1.4X_2 + 3.3\,X_3 + 0.6\,X_4 + X_5$$

where X_n represent the abovementioned ratio variables.

The decision rule is that credit should be conceded for debtors with a Z-score higher than 1.81 and denied for those with a score below 1.81.

In 2006, Altman re-estimated the model for private companies which resulted in different coefficients and threshold values:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

All of the variables stay the same, with exception of the X_4 variable which turns into book value of equity-to-total liabilities.

Zones of discrimination for this model are:

- $Z' > 2.9$ (safe zone, concede credit)
- $1.23 < Z' < 2.9$ (grey zone, further analysis required)
- $Z' < 1.23$ (distress zone, deny credit)

The model is known as Z'-Score and widely applied in financial industry.

Moreover, Altman developed a Z''-Score which is suitable to be applied universally for either listed or private, U.S. and non-U.S. corporations as well as for firms within and outside the manufacturing sector:

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$$

All variables are defined as for the Z'-Score with the difference that X_5 has been dropped.

Zones of discrimination for the Z''-Score are:

Z'' > 5.85 (safe zone, concede credit)

4.50 < Z''< 5.85 (grey zone, requires further analysis)

Z'' < 4.50 (distress zone, deny credit)

As a matter of fact, the Z-score model does not return any real probabilities of default. However, one can empirically match Z-scores with observed ratings and further on use the default probability associated with the respective rating.

When challenged by back-testing, Altman's Z-Score proved to be able to predict corporate bankruptcy two years in advance of a default event. Furthermore, it did very well in predicting the 2008-financial crisis when most rating agencies still assigned investment grades to highly distressed corporations.

We calculated Z''-Scores for the Banco Invest company set and conducted the empirical match between the Z''-Score and implied ratings by using a conversion table of S&P *(Appendix 11)*. We then compared the Z''-Score-implied S&P ratings and S&P-implied Banco Invest ratings with actual ratings obtained by their internal credit risk tool *(Appendix 12 & 13).*

When comparing the three different outcomes, one can see that the Z''-Score-implied S&P ratings and the implied Banco Invest ratings are fairly close to the actual bank ratings (average divergence of app. 1 rating step). Companies with good bank ratings tend to yield better results in terms of Z''-Score implied ratings. On the opposite, companies obtaining low scores in the bank rating model tend to obtain even lower Z''-score implied ratings. As an interpretation, this means that the Banco Invest tool seems to downgrade credit quality for good rating notches while it underestimates credit risk for lower-quality credit notches, taken the Z-score-implied ratings as a benchmark. Furthermore, it can be well observed that the majority of companies positions itself right at the threshold between investment and speculative grade, both for the Z-

score-implied (BB+/BBB) as well as for the actual bank ratings (6/7). This is perfectly captured in the assignment of a "grey zone" by the Z''-score for most of the companies.

It should be noticed that the Z-Score is a model purely based on financial statement information, not taking into account any qualitative type of information about the debtor. Industries can be affected to a different degree by these factors, therefore some bias in the results is understandable. For example, pharmaceuticals showed a Z-Score-implied rating which was much higher than the Banco Invest models' rating score. This might be due to the fact that the Z-score fails to take into account e.g. risks stemming from entry barriers imposed by competitors through application of patents or superior expertise.

Nonetheless, we still appreciate the Z-score method especially because it is easy to compute and mostly consists of financial statement data inputs. This resolves the issue of having public as well as private companies included in Banco Invests data set because financial statement data is readily available for both groups of companies. We would hence recommend its use to Banco Invest as it appears to be a holistic and easily applicable approach that can be used to reflect upon the ratings obtained through their own and our new credit rating model.

VI.2 Logit Regression Model

Binary regression models represent a direct method for estimating probabilities of default. There are logit and probit models which usually retrieve the same results. Nonetheless, logit models allow for a simple and straightforward interpretation which made us opt for this method. Starting with the data collection, we used "Amadeus" platform, a database run by Bureau van Dijk which is part of Moody's Analytics. Eventually, we decided upon using financial statement data from defaulted and non-defaulted companies which all belong to Eurozone countries. Only using data on Portuguese companies would have limited our sample to too few observations, hence the extension to other countries. We chose to use Eurozone countries because we wanted

to assure that they were close in characteristics to the Portuguese market and driven by a similar macroeconomic environment. It also allowed us to easily control for any possible currency effects. We excluded Ireland from the dataset because it was the only country that differed significantly with regard to its legal definition of bankruptcy as defined in civil law. Additionally, we restricted the selection of companies to entities that generated a minimum of €20 million in revenues in at least one year of the last 4 years where financial data was available. We did so in order to be in line with Banco Invest's company portfolio in terms of the business volume of companies we consider.

Apart from the aforementioned aspects, a proper and concise definition of the default state itself was crucial to derive accurate predictions. In our case, corporate default is defined as inactive companies in liquidation processes, bankruptcy procedures, dissolved through liquidation or dissolved through bankruptcy procedures. We were able to derive this information from the Amadeus platform.

All in all, we deployed a sample of 11,376 companies, of which 1,376 companies correspond to the default definition and the remaining 10,000 are randomly chosen non-defaulted companies which satisfy the restrictions mentioned before. With regard to the proportion of defaulted to non-defaulted companies, one has to make sure to include enough examples of default in order to obtain an accurate forecast. When researching this issue, we figured out that the minimum proportion of default companies to non-default companies should be 5%. Our data sample contains 13,67% of default companies, which complies with this requirement.

Having selected the companies that would deliver data for the vector of explanatory variables, further specifications of the model had to be made.

Logit models can be performed in a static or in a dynamic way. The first method models' PD based on a specific point in time while the second approach accounts for variability in the dependent and independent variables over time. Static models deliver better results in terms of

goodness-of-fit, nevertheless, they are limited to short-term predictions since there is a lot of uncertainty about the consistency of the coefficients when the model is applied to different points in time. Dynamic models use panel data as a support for the analysis, adding time as dimension. They usually lead to poor results in terms of goodness-of-fit, however, they are expected to be more consistent in the coefficients over time, since the model is able to capture variations caused by economic cycles and differences in the macro-environment. Hence, they are particularly more suitable for estimations that lie at much more distance in time.

In order to provide Banco Invest with a more powerful tool that takes time dimension into account, we chose to conduct the probability of default estimation using a longitudinal/panel data approach. This choice implied the collection of data from various years, what made us deploy Amadeus' resources of historical data at its maximum extent, downloading financial statement information from 2007 to 2016.

To secure the data quality, we performed some pre-processing by transforming certain variables and subsequently checked on outliers. Some coverage ratios were transformed due to their possibility of taking on indeterminate forms. We have found several cases of companies with no financial debt, consequently no interest payments, so whenever the company had zero interest, we increased this value to one. Additionally, variables which had an income statement account as denominator that could easily take on negative values (e.g. EBIT, EBITDA) were inverted in order to conserve monotonic properties. To limit the influence of outliers, we winsorized the variables in our model at the 5th and 95th percentiles of their pooled distributions across all firm-years. That is, we replace any observation below the 5th percentile with the value at the 5th percentile, and any observation above the 95th percentile with the value at the 95th percentile. Furthermore, we assume that companies go bankrupt in the year following the last available entry of financial data, so if the last financial statements are available in t, the company defaults in t+1.

Once all of the data pre-processing and checking was finalized, we could turn to the actual logistic regression. Logistic regressions are optimally suited to do the binary classification into "non-default" (y = 0) and "default" (y = 1) that we need to figure out. The vector $X = (X_1, \ldots, X_m)^T$ of creditor characteristics (the financial statement data, we pre-processed earlier) serves as input for the logistic function which will return the probability of default. In more detail, it is expressed by

$$logit(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_{1,i} + \cdots + \beta_m x_{m,i}$$

or alternatively,

$$p_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_{1,i} + \cdots + \beta_m x_{m,i})}}$$

where

p = probability of default

x_i = explanatory variables

β_i = coefficient obtained through the regression

n = number of explanatory variables.

For our data set, it is known whether the creditor has defaulted or not in a given time period, i.e. whether the probability p equals 1 or 0 instead. The challenge hence is to find coefficients β_i which make the model-predicted probabilities of default closer to the actually observed outcome.

We refrain from using absolute values for the explanatory variables in a sense that we could not use e.g. sales as a standalone variable input for our regression model. We rather used relative values meaning that e.g. we had to set sales in relation to total assets. The reason for doing so is that using absolute measures will lead to a high dispersion in values that are plugged into the regression. The use of ratios instead smoothed out any extreme values and will hence lead to better results for the regression model coefficients.

Furthermore, when setting up the regressions, special attention had to be paid for the number of independent variables to be included in the formula as well as for the combination between them. This is because we needed to avoid that the model would be overfitted or suffer from multicollinearity.

As a first attempt, we examined whether the ratios used in the Financial Profile and Financial Policy part of our credit rating model (e.g. EBITDA/Interest, EBITDA Margin and inverted Debt/EBITDA) had any explanatory power in predicting the default likelihood. Trying out different combinations of variables within fixed as well as random effect models repeatedly showed us that EBITDA margin captured all the explanatory power while the rest of the variables were not significant. P-values of EBITDA margin were close to 0 while the p-values were not significant at a 5% or 10%-level for all the other variables. This result was not satisfactory because capturing a lot of explanatory power in only one variable of the model might be a hint for collinearity. We noticed that when we excluded EBITDA margin, the coefficients of the remaining variables changed a lot, which supports the assumption of presence of collinearity.

Furthermore, our motivation was to create a regression model that would include at least one significant coverage and leverage ratio to be aligned with the rating model that we created. In order to find out about other potentially significant variables, we turned to the ones deployed in Altman's Z-score.

Most of the ratios used in Altman's model could be calculated from the available data. However, we had to drop retained earnings-to-assets ratio because Amadeus does not provide information on retained earnings. Working capital-to-assets was also not included because it is expected that companies with a lower ratio will have a higher risk of default and it is expected that companies close to default would see this ratio shrink. Nevertheless, low working capital can also reflect a higher bargaining power with clients as well as operating efficiency. By using this ratio,

companies with naturally low levels of working capital, such as retailers, would be strongly penalized by our model, not reflecting their true probability of default. When including working capital-to-total assets in the regression model and back-testing the result, we got an abnormal high probability of default for Banco Invest retail companies, which was not consistent with the results of the internal rating model for the same companies.

Altman's EBIT-to-total assets and Sales-to-total assets ratios showed high significance in several models. However, the Equity-to-total liabilities ratio was not significant which made us transform it into assets-to-total liabilities which yielded good results. We chose this ratio because it preserves the original ratio's structure of being an inverted solvency ratio.

Moreover, for reasons we explained earlier, we added one additional coverage measure, namely EBIT-to-interest because the Altman's model itself does not include any interest coverage ratio.

All in all, we ended up with four different explanatory variables: EBIT-to-total assets, Sales-to-total assets, Assets-to-Liabilities and EBIT-to-interest.

We expect that the coefficients of the Altman-variables that we adopted for our model to yield similar results as in the Z-score model. Being so, EBIT-to-Assets and Sales-to-Assets should have shown negative signs, since the larger the ratios, the lower the probability of default.

This reasoning is also true for Assets-to-Liabilities and EBIT-to-interest.

Being a solvency ratio, Assets-to-Liabilities depicts how much of a company's liabilities can be covered by the existent assets in case of a sudden solvency issue. If one prefers to look at the more common inverted ratio, Liabilities-to-Assets, the insight is the same, but with a slightly different reasoning. Here one is looking for how much of a company's assets were financed through liabilities. The rule is that the higher the proportion between assets and liabilities, the better, so we expect our ratio to negatively impact probability of default, hence the coefficient sign should also be negative.

EBIT-to-interest is a common interest coverage ratio, picturing how much profit is generated to cover short-term interest payments. It measures how many times the firm could pay its current interest payments with the profits it generates. As said before, the larger the ratio, the safer the company is, therefore the sign of the coefficient is also expected to be negative.

The characteristics of these variables suggested that collinearity was not present. Purely looking at the correlation matrix below, one can recognize that there is no incidence of elevated correlation between these variables. Secondly, we have conducted a regression with these variables and have taken the Variance Inflation Factor (VIF). Results for the factor were fairly low, which is as well indicative of the absence of multicollinearity. Finally, after altering our model several times by removing and adding back different variables, we realized that the remaining coefficients did not change dramatically which is another good indicator for the absence of multicollinearity.

Correlation Matrix

	Default	EBIT/Total Asset	Sales/Total Asset	Total Asset/ Total Liabilities	EBIT/Interest
Default	1	-0.3	-0.03	-0.15	-0.15
EBIT/Total Asset	-0.3	1	0.11	0.36	0.55
Sales/Total Asset	-0.03	0.11	1	0.04	0.18
Total Asset/Total Liabilities	-0.15	0.36	0.04	1	0.28
EBIT/Interest	-0.15	0.55	0.18	0.28	1

Econometric research has come up with different approaches to determine the coefficients of this binary model. The most used one is the fixed effects model. This method is mostly used whenever the econometrician wants to understand the impact of the variables that vary over time. The main assumption behind is that there are some individual characteristics, for instance the country or industry a company operates in, which can impact or bias the coefficients. In other words, there is correlation between each entity's error terms and the independent variables. Hence, fixed effect models remove the effect of these characteristics that do not vary over time, leading to more consistent coefficients for the regressors that remain in the regression

model. Another important assumption is that those time-invariant features are unique for a single company and therefore should not be correlated with the characteristics of other companies. Explained in a mathematical way, the error term of each entity as well as the constant, which captures those invariant characteristics, should not be correlated with those of other companies.

As a second alternative, one may use random effects models. These models assume that differences between companies can have a high impact on the dependent variable. Thus, one can use time-invariant regressors such as country and industry, under the assumption that the company's error term is not correlated with the regressors. In other words, differences across entities are hypothesized as being random and uncorrelated with the regressors.

Fixed effects models seem to be the more appropriate approach for our model since we want to evaluate in general terms what drives bankruptcy for any kind of company, independently from the industry it belongs to. Nevertheless, we have done a Hausman Specification test to determine which method is indeed the correct one. Under the null hypothesis, the difference in the coefficients is non-systematic meaning that random effects models are the proper method to choose, otherwise the alternative states that fixed-effects models are the better choice. In our case, the null hypothesis is rejected, therefore we should use fixed effects.

Hausman Specification Test

	X fixed	X random	Difference	S.E.
EBIT/Total Asset	-7.7	-6.31	-1.39	0.38
Sales/Total Asset	-0.15	-0.03	-0.13	0.04
Total Asset/Total Liabilities	-1.7	-0.44	-1.25	0.16
EBIT/Interest	-0.01	0	-0.01	0
Chi^2	144.70			
Prob. > Chi^2	0.00			

By selecting this model, all the non-default companies have been dropped from the estimations since there is no variation in the dependent variable. Furthermore, default companies with only one year of observation were also dropped due to lack of variability.

We have tried different combinations of the four aforementioned variables and selected the final one based on relative goodness-of-fit measures, the Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC). According to these criterions, the final model turned out to be the one composed by all of the four variables, EBIT-to-Assets, EBIT-to-interest, Assets-to-Liabilities and Sales-to-Assets.

Also, pseudo-R^2 were computed, McFadden (0.2384), Cox+Snell (0.1203) and Nagelkerke (0.2892), whose results represent a good overall fit for this kind of regressions.

We could not include lagged variables or first differences due to the initial transformations we have done with the data. We expected to find extreme values for most variables close to default events, being located either below the 5th percentile or above the 95th percentile. Due to the transformation, those variables would retrieve the same value over different years, possibly biasing the coefficients of the predictors.

Dynamic Regression Outcomes:

	Coef.	Std. Err.	z	p>|z|	[95% Conf. Interval]	
EBIT/Total Assets	-7.698	0,531	-14.50	0.00	-8.739	-6.657
Sales/Total Assets	-0.152	0,041	-3.69	0.00	-0.233	-0.071
Total Asset/Total Liabilities	-1.695	0,194	-8.70	0.00	-2.077	-1.313
EBIT/Interest	-0.006	0,003	-2.04	0.04	-0.012	0.0002
Log likelihood	-1387.17					
LR chi2 (4)	868.34					
Prob. > chi^2	0.00					

With all the regression coefficients in place, it is now possible to calculate actual PDs for all Banco Invest companies by using

$$p_i = \frac{1}{1 + e^{-(\beta_1 x_{1,i} + \cdots + \beta_j x_{j,i} + \cdots + \beta_m x_{m,i})}}$$

We substitute all β_j by the coefficients obtained from the regression and all $x_{j,i}$ by the respective financial statement data input for each company.

As a next step, we calculated estimation errors from the PDs we obtained. There can be two different types of errors caused by an incorrect prediction of default. Firstly, for a given threshold of default risk, the model does not predict the default when default actually happened. In other words, let's consider an analyst who defines that 7% probability of default is his limit of risk at which he is willing to invest in a company/security. The first error type captures all the default events that have actually happened in the following year, when the model-estimated probability was in fact lower than the threshold.

The second type of error occurs, if for a given threshold of default risk, the model predicts default when default actually did not happen. Appendix 14 presents the two error types mentioned for a set of different thresholds of risk. In red, we clearly see that when the threshold of risk increases, the model is less able to account for default events when they actually happen (Type I error). Saying in another way, if an investor is not willing to invest in companies with more than 5% of PD, about 15% of the total bankruptcy events in one year had an estimated probability lower than that 5%. In the other extreme, if the threshold is 50%, 80% of the companies that have defaulted in the next year are inside his portfolio. In theory, this value can be reduced to zero the better the model fits. However, our model cannot differentiate e.g. whether a company defaulted due to financial fraud or not. If so, financial accounts could have been artificially inflated and these numbers will be captured by our model, not reflecting the actual financial health of the firm. Since we only have limited options to exclude these effects, we will keep obtaining a certain level of estimation errors.

One might be biased towards a more conservative approach (lower risk-threshold), however that can also limit the potential portfolio due to the second type of errors, graphed in orange. In our model, for a threshold of 5%, almost 70% of the companies that didn't default in the next

year will be excluded from the portfolio, due to estimation error. This error behaves in the inverse way as the other one, so the higher the threshold the lower the number of excluded companies. The second error type was taken from an in-sample analysis, only composed by default companies, hence being possibly too biased for default events in periods when default did not actually happen. For a more accurate calculation of these errors, one should calculate them using out-of-the-sample companies, where a substantial reduction in the volume of these errors can be expected. The series in grey *(Appendix 14)* indicates how these errors behave when the model is applied to another sample of data on 65,535 companies from 2015 that did not default in 2016 and where the same restrictions as in the previous sample were imposed to. The results strengthen the hypothesis of strong bias in the default group which overestimated the true probability of default. The following graph indicates possible points for the choice of the optimal threshold which minimizes both error types. Looking at the results, it seems reasonable to select thresholds below 10%.

The results shown can be analysed in a different way when looking at the relationship between estimated probability of default and the number of years before the default event *(Appendix 15)*. Not surprisingly, the further away we are from the default event, the lower the estimated probability of default we obtain. However, there is a significant change two years before the default event, not only in the average of companies' probability of default, but also in its median. This can have significant implications for our model. Even though being build up to predict default within one year's horizon, it seems like our model is sensitive enough to capture changes in the probability of default that are more distant in time. On the other hand, the second error type described above (in-sample analysis) can be mostly driven by the poorer performance of the variables of the model in the years close to the default event.

In Appendix 16, we show that, for a threshold of 5%, the second error type diminishes when removing the observations closer to the default event, as suggested by the previous graph.

Nevertheless, due to the minimal amplitude of the change, we may conclude that most of those errors are intrinsic to the goodness-of-fit of the model itself.

Furthermore, we have estimated the model with lagged values of the previous variables in order to test whether it is possible to estimate probability of default at a two years' horizon. The regression below proved to be worthy, confirming our hypothesis from before.

Dynamic Lagged Regression Outcomes

	Coef.	Std. Err.	z	p>|z|	[95% Conf.	Interval]
EBIT/Total Assets	-6.969	-0.575	-12.11	0.000	-8.097	-5.841
Sales/Total Assets	-0.131	0.045	-2.87	0.004	-0.221	-0.041
Total Asset/Total Liabilities	-1.161	0.200	-5.80	0.000	-1.553	-0.769
EBIT/Interest	-0.005	0.002	-1.84	0.065	-0.011	0.0003
Log likelihood	-1523.06					
LR chi^2 (4)	456.21					
Prob. > chi^2	0.00					

However, when comparing the AIC and BIC of the two regressions as presented below, one can clearly state that our previous model is much better in terms of fit, since both of them are much lower in the first model. By looking at the Pseudo R^2, one may conclude the same, since McFadden (0.1303), Cox+Snell (0.071) and Nagelkerke (0.1644) are also much lower than in the non-lagged model. Moreover, when calculating the two types of errors, the results were much poorer than before, with strong exposure to those errors at any given threshold of risk. Henceforth, we do not use the lagged regression coefficients to determine PDs.

Comparison of AIC and BIC measures for both regression models

	AIC	BIC
Dynamic Model	2,782.34	2,809.62
Lagged Model	3,054.11	3,081.04

Using the results of the logit regression model, we then proceed to its implementation for Banco Invest's company portfolio. We wanted to primarily find out if there was a consistent inverse

relationship between the probabilities of default obtained through the regression and the rating scores derived from the internal Banco Invest model.

We conducted the same data pre-processing for the financial statement variables as described in the setup of the logit regression. We calculated 5th percentile and 95th percentile threshold values for all the four variables that feed into the regression by deploying a set of 1,206 defaulted and non-defaulted companies belonging to the Iberian market. Following the results we obtained, we suggest limiting the variable inputs for each Banco Invest company according to the following table:

Percentile Bound Limitation

Variable Transformation Table	
EBIT/assets – upper bound	0.34
EBIT/assets – lower bound	-0.46
Sales/Assets – upper bound	11.5
Sales/Assets – lower bound	0.1
Assets/Liabilities – upper bound	7.0
Assets/Liabilities – lower bound	0.5
EBIT/Interest – upper bound	125.0
EBIT/Interest – lower bound	-25.0

The probabilities of default we obtained for Banco Invest's company portfolio are presented in Appendix 17.

In general terms, the regression model seems to capture most of the enhancements or deteriorations in the level of internal ratings with probabilities of default decreasing or increasing gradually in most cases. *Hovione* again appears as the best company to invest in in terms of PD, which is consistent with the internal rating as well as the Z''-Score. *Mota-Engil* continues to be the worst company also by probability of default which confirms the results we obtained from the Z''-Score and the Banco Invest tool. Furthermore, it can be observed that the logit model seems to perform better using the latest financial statement data available because

the inverse relationship between PD and rating score is more consistent here than with data inputs from one year back in time.

Notwithstanding the mostly satisfactory results that we obtained, we see a couple of limitations and weaknesses in our logit regression model. First of all, the model is not able to control for industry specific characteristics that similarly affect ratio inputs. One could have also created a model for each industry using the fixed effects approach, where the coefficients would have returned a more precise PD when compared to the actual industry PD.

An industry-tilted approach would have, however, been challenged by highly diversified companies whose mix of sectors would have been difficult to capture in a regression model. Moreover, we did not dispose of enough data resources to run industry-specific regressions. By maintaining the standardization of our regression model, we forego these problems at the expense of more imprecise coefficients and PD outcomes.

Another pitfall might be linked to our data sample itself. Similar academic studies have used data where observations were measured at higher time frequencies, with quarterly or monthly data, over a longer period of time, sometimes up to 40 years. Our model was designed to estimate the probability of default for private and public companies, where the information availability for private companies is typically restricted to annual financial reports. Therefore, the frequency of time periods between observations cannot be changed. Moreover, our model is based on ten years' data, which were characterized by high volatility and an economic recession. We attribute some of the inaccurateness in results to this aspect, but at the same time think that our model will deliver more precise results over time, as more years of information will be available on Amadeus platform and included in the regression.

An additional weakness resides in the fact that we could not match the estimated PD from the regression model with the implied PD for a certain rating score. The most common approach to compute the implied PD is by using cumulative default rates. This method sorts the data

given a specific endogenous classification, for instance, rating scores, and calculates the proportion of companies that have defaulted conditional on that classification. This process is more complex the more years one adds because it is built up by marginal default rates. However, our model only pretends to estimate default events for a one-year horizon, therefore we cannot carry out this method. To give an example, one could estimate the implied probability of default by joining all the companies with the same S&P-implied rating score and calculate how much of them have defaulted on a one-year horizon. This proportion will then be the implied PD associated with that rating score. This method of estimation enables the incorporation of qualitative information in the model, endogenous to the rating score, which cannot be accessed by our model. While being strictly limited to rated companies, this method is obsolete for private non-rated companies.

VI.3 Comparison of Results for Test Sample

As a last step of our analysis we want to compare and contrast results from Z''-Score calculations, Z''-Score-implied S&P ratings, Banco Invest ratings and the probability of default with results of our new rating model. We use the same sample of Banco Invest client companies as in the test performed in the previous chapter. While we have compared single components of this table in earlier passages of the report, we would now like to give a comprehensive overview of the results with special focus on implications for our model proposal.

Company	Z''-Score		Z''-Score-impl. ratings		Banco Invest Ratings		Logit PD		Nova SBE rating	
	y	y-1	y	y-1	y	y-1	y	y-1	y	y-1
Jerónimo Martins	10,89	7,15	10	9	9	9	1,81%	2,56%	9	8
Hovione Farmaciencia	8,65	7,54	10	9	8	8	0,22%	0,32%	7	8
Galp Energia	6,05	5,93	7	7	8	7	1,65%	2,34%	7	6
Eletricidade Dos Açores	5,32	4,91	6	6	8	8	3,27%	4,19%	7	7
Colep Portugal	5,31	5,12	6	6	7	6	3,24%	4,75%	6	6
Dufry AG	5,19	4,69	6	5	7	6	5,38%	6,35%	7	7
Sovena Oilseeds Portugal	5,32	5,46	6	6	6	7	5,88%	4,44%	6	6
Empresa de Electricidade da Madeira	4,25	4,35	5	5	6	7	8,07%	7,84%	6	7

The companies are sorted in descending order according to the Z''-Score. At first sight, one can see that for the last year of available company data, our model delivers gradually decreasing rating scores, except for Dufry. When taking data from one year earlier, the decrease is not as gradual, but at the same time, ratings do not jump or diverge to much from a monotonically decreasing behaviour. Furthermore, our rating outcomes are close to Banco Invests ratings, with a maximum deviation of 1 rating step and a match in ratings of 43,75%. Our model tends to return lower ratings for high-quality credit notches than Banco Invest's tool while it delivers approximately equal results for lower-quality credit classes. We think this outcome is justified in light of the fact that we deal with several private companies in the data set where data availability is scarce. We hence accept the more prudent and conservative outcome of our rating tool and do not consider it as a critical. The probabilities of default that we derive from the Logit model do not always show an inverse relationship to a given increase/decrease in our rating model and they also do not show any specific pattern in how they grow or decline. Nonetheless, a rough increase in PD can be observed along weakening credit notches of our rating model which should be satisfactory in light of the limitations that we faced when setting up the regression.

All in all, the comparison of results for the test sample should be interpreted in a way that no model can be said to deliver perfectly reliable results when considered in isolation. Nonetheless, the proximity of result and observable tendencies leave us confident that our proposed model appears to work out decently. While we compared our model to Banco Invest's model earlier in the report by a few self-imposed quality criteria, here, we find its quality confirmed even stronger by its approximate correspondence in tendencies to Z''-Score and PD measures.

VII

Conclusions

As outlined in the introduction of the work project, our goal was to develop a credit scoring model for large to medium-sized corporate clients of Banco Invest. The internal rating model currently used by Banco Invest's credit department served as starting point for the project and was to be improved during the course of our work. Moreover, we were supposed to add methodologies which facilitate the measurement of probabilities of default, a feature that the original credit scoring model did not cover.

We unfolded with the thesis project by deeply analysing the internal rating tool and various data sets the bank placed at our disposal. The subsequent set-up of our own rating model which builds upon the original model required the application of knowledge spanning various areas of finance such as accounting, financial statement analysis, corporate finance and macroeconomics. The tool that we obtained includes insights from Moody's and Standard & Poor's rating methodologies, the application of theories provided by academic literature, suggestions from the staff at the Banco Invest credit risk department as well as our own reasoning based on the knowledge we acquired during our Master studies. Our main modifications entail a differentiation of the company portfolio by industries, the respective adaption of model weights by sector, review of model factors and adjustments of rating scorecards.

As a next step, we were supposed to elaborate models that allow for the estimation of the probability of default, which required us to refer back to econometric and statistical theory in order to come up with both, the Altman Z-Score and the Logit regression model.

After having developed these two pillars of our thesis project, we were challenged to find out whether our proposed credit risk model would yield results that were able to properly capture the different variables that drive credit risk and would hence lead to a precise assessment of the

actual credit risk exposure of a company. In order to solve this question, it proved helpful to compare and contrast both pillars with one another. In this way, the probability of default measures were not only an extension of Banco Invest's original model but moreover useful in verifying and substantiating the proper functioning of our new model. We tested our rating scores against those obtained by Banco Invest and again compared all of the rating scores to the probability of default measures that we newly established for the entire company portfolio of Banco Invest. The results we obtained were by far not perfectly corresponding in their values and meaning, nevertheless, they also did not overly diverge from another and oftentimes indicated the same tendencies and behaviours regarding the assessment of default risk exposure. The excel model, we additionally created, translates all of this report's content in an easy-to-use application, facilitating Banco Invest with the option to make the aforementioned comparison with only a few data inputs.

As several of our model inputs are tilted to current economic conditions and will consequently change over time, the rating model needs to be updated frequently. The same applies to the logit regression model where we suppose that it will deliver more precise results the more data becomes included over time.

Finally, we would like to reinforce at this point that all the measures we present in this thesis should not be regarded as stand-alone metrics that claim to have to ability to perfectly predict corporate financial stability. We rather perceive them to work best when evaluated as a group of indicators, each one of them having its own informative value. While our credit risk model can be blamed for being biased due to subjectivity in the assessment of qualitative factors, models that are purely based on financial data inputs may particularly lack informational content transmitted by those factors. Considering both as complementary to one another and evaluating them within one aggregate analysis can lead to enhanced rating assessments since one method will compensate the drawbacks from the other one.

VIII

Appendix

Appendix 1 - *Banco Invest "Scale" Scorecard*

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Revenue (in € MM)	> 3000	> 1500	> 750	> 500	> 250	> 200	> 150	> 100	> 50	< 50

Appendix 2 - *Banco Invest "Financial Profile" Scorecard*

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	Caa 2	Ca 1
Net Debt / EBITDA	< 0,5	< 1,25	< 2	< 3	< 4,5	< 6	< 8	< 10	< 12	> 12
EBITDA / Interest Expenses	> 20	> 15	> 10	> 6	> 3	> 2	> 1	> 0	< 0	-
RCF / Net Debt	> 80%	> 60%	> 40%	> 25%	> 15%	> 7,5%	> 2,5%	> 0	< 0	-
(FFO - Capex) / Debt	> 25%	> 20%	> 15%	> 10%	> 5%	> 0%	> -5%	< -5%	-	-

Appendix 3 - *Banco Invest "Business Profile" Scorecard*

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	Caa 2	Ca 1
Characteristics of Market Demand	Highly stable; Essential Products/Services; Impermeable to business cycles. Products / Services (P/S) with well-known history	Stable and reliable demand, though could have some exposure to economic cycles. P/S very necessary on daily basis, with low elasticity (ex. essential aliments) and remote possibility of substitute products. Competitive differentiation very high. P/S with well-known history	Mostly stable, with modest exposition to economic cycles. High differentiation of P/S, with low elasticity and historical known. Moderated risks of technological obsolescence or some substitutes. The variations of revenues are relatively small, though could have significant changes over the years	Stable demand on the medium term; moderated exposure to economic cycles or in the industry; Relevant differentiation of P/S; Some historical. P/S important, though the postponement of purchases occurs according with the economic cycles. Demand shows some price elasticity; risks of technological/trend obsolescence. Revenue variations could be significant	Expected stable demand on the short term; Significant exposure to economic cycles/industries. Some recent historical. P/S have some discretionary characteristics; being evident the postponement of purchases for macro-economic reasons; Elastic demand with moderated product substitution. Revenues variation could be significant (>10%/year)	Recent strong demand, but the stability along the economic cycle is more uncertain; P/S differentiation limited. Products moderated discretionary, with easily postponement of purchases; Elastic demand; high risk of technological/trends obsolescence; substitute products are easily. Revenues with significant variations and market with observable variations	Recent P/S with path of unknown demand across the economic cycle. Lower or none historical. Few differentiations. Highly descriptive or niche products; significant postponement or cancellation of purchases by macro-economic reasons. Company revenues with significant variations or in structural decrease;	New P/S with evolution of unknown demand. Without differentiation. D/S not important for the consumer	---	---
Growth potential of the company	Higher and sustainable organic growth	Predictably organic growth above nominal growth of GDP	Predictably organic growth above nominal growth of GDP	Predictably organic growth close to nominal growth of GDP	Predictably organic growth below nominal growth of GDP	Negative organic growth rates for most of the products; high risk of replacement; secular decline in demand for some products	Growth rates for the most of P/S significantly negatives/ demand for mostly of P/S in structural decline	Market in decline for mostly of P/S of the company. Market may be disappearing completely over a time horizon of 3 to 5 years	---	---
Competitive profile	Multiple business segmentation, with a wide range of services; Final Market is well diversified, without costumer's concentration	Multiple business segmentation, with a wide range of services; Final Market is well diversified, without costumer's concentration	Several business segmentations with a wide range of services in some of them; Final Market is diversified, minimum costumer's concentration	Several business segmentations with a wide range of services at least in of the principal segmentation; Final Market is diversified, some costumer's concentration	Some business segmentation with a wide range of services at least in of the principal segmentation; Principal market with some diversification, moderated	Some business segments, but it depends on one of them; High costumers' concentration	Operates only in one business segment, with high costumers' concentration; P/S with commodity characteristics;	Operates only in one business segment, with very high costumers' concentration	---	---

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	Caa 2	Ca 1
Technological Positioning	Technology leadership limits threats to the competitive position and supports the improvement of current competitive positions or new market opportunities	Technology leadership results in few threats to competitive position and new market opportunities.	Technological leadership provides significant barriers to entry	Technological and operational know how limits competitive threats	Limited differentiation based on technology or know how	No differentiation based on technology or know how	Substantial technological or structural disadvantages	Permanent structural or technological disadvantages	---	---
Geographical and business diversification	3 or more distinct business segments, with each representing at least 15% of the NPV and the largest market with less than 25% of the NPV.	(A) 3 or more distinct business segments, with each representing at least 15% of the NPV and the largest market with a weight> 25% of NPV; OR (B) 3 or more separate business segments, with each representing at least 10% of the VN and the largest market <25% of the VN	(A) 3 or more distinct business segments, with each representing at least 10% of the NPV and the largest market with a weight> 25% of NPV; OR (B) 3 or more distinct business segments and the largest market <25% of VN	(A) 3 or more distinct business segments and the largest market with weight> 25% of NPV; OR (B) 2 or more distinct business segments, each with more than 15% of the VN and the largest market <25% of the VN.	(A) 2 or more distinct business segments, each weighing> 15% and the largest market with a weight> 25% of NPV; OR (B) 2 or more distinct business segments, each with more than 10% of the VN and the largest market <25% of the VN.	(A) 2 or more distinct business segments, each weighing> 10% and the largest market with a weight> 25% of NPV; OR (B) 2 or more distinct business segments and the largest market <25% of VN.	(A) 2 or more distinct business segments and the largest market with a weight> 25% of NPV; OR (B) 1 distinct business segment and the largest market <25% of VN.	(A) 2 or more distinct business segments and the largest market with a weight> 25% of NPV; OR (B) 1 distinct business segment and the largest market> 25% of VN.	---	---

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	Caa 2	Ca 1
Competition	Dominant position with minimal competition in activities that are difficult to replicate; Strong entry barriers reduce the likelihood of new competitors. Dominant market share (> 70%)	Dominant position with some competition from smaller competitors; P/S are difficult to replicate without large-scale investments that are not within reach of most competitors; Strong barriers to entry; new competitors are rare. Oligopolistic industry characteristics (2/3 players have more than 80% MS)	Strong position but with some competition; P/S can be replicated but with significant investments. Barriers to entry provide sustainable protection of market share. Market share of leadership (> 40%) in industry with limited competition	Barriers to entry or high switching costs limit the entry of new competitors. P / S can be replicated but with significant investments. Market share (>33%)	Limited entry barriers / low switching costs encourage new competitors. Investments necessary to maintain brand/market positioning. Costs of entry into the market are reasonable for most potential competitors. Market share> 20% or strong niche player	P/S can be differentiated through investments; may have difficulty maintaining margins/NPV; No barriers to entry or little change costs encourage new competitors. Local or niche player in a key market or segment	No barriers to entry; service has commodity characteristics. Small player comparing with competitors. High risk / pressure to maintain margins	No barriers to entry; P/S has commodity characteristics. Very small player comparing with competitors	---	---
Exogenous factors	Access to multiple suppliers, company has strong negotiating ability on these; Use of raw materials/commodities with global markets; State and Regulators with little or no intervention	Access to multiple suppliers, company has some negotiating ability; State and Regulators with little or no intervention or intervention to protect	Access to multiple suppliers, balanced trade relations between the parties; State and Regulators may have some intervention but limited, being an open market	It has alternatives for major suppliers, although one may have greater negotiating capacity; State and Regulators have some intervention but is in general an open market	Some suppliers have greater negotiating capacity than the company; State and Regulators have any intervention in the market that can affect profitability	A large part of the NPV (> 30%) depends on 1 or 2 suppliers with greater negotiating capacity than the company; State and Regulators have active intervention in the market setting prices and/or margins or through concessions	More than 50% of the NPV depends on 1 or 2 suppliers with greater negotiating capacity than the company; State and Regulators have active intervention in the market setting prices and/or margins or through concessions	More than 50% of the NPVV depends almost exclusively on 1 supplier with greater negotiating capacity than the company; State and Regulators have active intervention in the market setting prices and/or margins or through concessions	---	---

Appendix 4 - *Banco Invest "Financial Policy" Scorecard*

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	R 1
Shareholders	Majority shareholder (s) have very strong ability to raise / realize capital increases if necessary; Very strong shareholder stability (<10 years)	Majority shareholder (s) have very strong ability to raise / realize capital increases if necessary; Strong shareholder stability (<5 years)	Majority shareholder (s) have strong ability to raise / realize capital increases if necessary	Major shareholders have the capacity to raise / realize capital increases if necessary and are stable (<5 years)	Major shareholders appear to be able to raise / realize capital increases if necessary, but there is some lack of knowledge about them	Some of the major shareholders appear to be able to raise / realize capital increases if necessary, but a relevant part could have difficulties	Unawareness of ability / commitment to raise / realize capital increases if necessary	Doubts about capacity / willingness of major shareholders to raise capital increase	Capacity / willingness of major shareholders to increase or limit capital increase	Limit or inexistent capacity / willingness of major shareholders to increase capital
Governance	Professional management with solid track record. Structure of governance and clear control and with defined and independent roles. Clear separation between management and shareholders	Professional management with industry experience. Structure of governance and clear control and with defined and independent roles. Clear separation between management and shareholders	Management recognized by the market and with a solid track record (>5 year in the company); Independent governance and control structure. Independent management of shareholders; Businesses with irrelevant or negligible shareholders	Management recognized by the market and with a good track record (majority with> 3 years in the company); Independent governance and control structure. Independent management of shareholders, Business with minor shareholders	Management with good track record (> 3 years in the company); Governance and control structure seemingly without problems. Management can be confused with shareholders. Business with limited and transparent shareholders	Management relatively indifferent in the market or without references; Governance and control structure may be unclear. Management confuses itself with shareholders. Business with shareholders may be relevant but transparent and justifiable	An unfavourable view of Management in the market and / or with little experience in the company (<3 years); Governance structure and control unclear or absent. Management confuses itself with shareholders. Business with relevant shareholders and unclear justification	Unfavourable background and / or little experience in the company (<3 years) and in the sector; Absence of governance and control structure. No reference to independent management of majority shareholders. Business with significant and unclear shareholders	Negative Management History or unfavourable perception. Experience in the sector and / or limited company. Absence of governance and independent control. Businesses with significant shareholders and no apparent logical justification	---

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Ca 3	C 2	R 1
Financial Policy	Expectable stable and extremely conservative financial policy; very strong and stable metrics; Public commitment to the highest long-term credit profiles	Expectable stable and extremely conservative financial policy; very stable metrics; Public commitment to a strong long-term credit profiles	Predictable financial policy, which preserves creditor interests; Modest risks of negative events; small and temporary variations in leverage; Commitment to solid long-term credit profile	Financial policy that balances the interests of the creditor and the shareholder; Some risk of using debt for acquisitions or distribution to shareholders and that may lead to a more fragile credit profile	Financial policy may favour interests of the shareholder rather than the creditor; Above average risk due to the use of debt for acquisitions or distribution to shareholders or other significant changes in the capital structure	Expectable a financial policy that creates high financial risk of debt restructuring under various macroeconomic scenarios. Use of debt for acquisitions or distribution to shareholders or other significant changes in the capital structure	Financial policy that creates high financial risks and possible debt restructurings, even in favourable economic environments	---	---

Appendix 5 – *S&P Standard Competitive Position Group Profile by Sector and Industry*

Capital and Asset-Intensive Industries	
Transportation	Airlines Marine Trucking
Auto OEM	Automobile and Truck manufacturers
Pharmaceutical	Pharma Biotech
Homebuilders	Homebuilders
Forest products	Forest products Paper products
REITs	REITs Real estate operating companies
Auto suppliers	Auto parts and equipment Tires and rubber Vehicle-related supplier
Technology - Hardware and semiconductors	Communications equipment Computer hardware Computer storage Electronic equipment and components Electronic manufacturing Technology distributors Semiconductors
Specialty chemicals	Industrial gases Specialty chemicals
Capital Goods	Electrical components and equipment Heavy electrical equipment Industrial machinery Construction and farm machinery
Building materials	Building materials
Package express	Air freight and logistics
Containers and packaging	Metal and glass containers Paper packaging
Merchant power	Independent power producers and energy traders Merchant power
Aerospace and defence	Aerospace and defence
Health Care equipment and service	Equipment and Supplies Equipment and Service

Services and Branded Products Industries	
Leisure and sports	Casinos and gaming Hotels, resorts, and cruise lines Leisure facilities
Engineering and construction	Engineering and construction
Business services	Security and alarm services Facilities management services Human resource and employment services Research and consulting services Insurance brokers and related service providers
Technology - Software and service	Internet software and service IT consulting Data processing System software
Consumer durables	Home furnishings Household appliances Leisure products Luxury goods Textiles Apparel, accessories goods
Media and entertainment	Commercial printing Advertising Broadcasting Movies and entertainment Publishing
Retail	Catalogue retail Internet retail Apparel retail Automotive retail Home improvement retail Department stores General merchandise stores Specialty stores Computer and electronics retail
Branded nondurable	Brewers Distillers and vintners Soft drink Packaged foods and meats Tobacco Personal products Household products
Telecom and cable	Cable and satellite Alternative carriers Integrated telecommunication service Wireless telecommunication service
Environmental services	Environmental and facilities services

National Industries and Utilities	
Utilities	Electric utilities Gas utilities Multi-utilities Water utilities
Transportation infrastructure	Railroads Airport services Highways Rail tracks Marine ports and services

Pure Commodity Sector	
Raw Commodity	Aluminium Steel Coal and consumable fuels Diversified metals and mining Gold Precious metals and minerals
Oil and gas production	Integrated oil and gas Oil and gas exploration and production
Oil and gas drilling, equipment and service	Oil and gas drilling Oil and gas equipment and services
Midstream energy	Oil and gas storage and transportation
Commodity chemicals	Commodity chemicals Diversified chemicals Fertilizers and agricultural chemicals
Agribusiness and commodity foods	Agricultural products

Appendix 6 - *Banco Invest Companies Sector Allocation*

Company	Sector Allocation	Industry
Almirall S.A.	Capital and Asset-Intensive	Pharmaceutical
Altri, SGPS, S.A.	Capital and Asset-Intensive	Forest products
	National Industries and Utilities	Multi-Utilities
Bial Portela, S.A.	Capital and Asset-Intensive	Pharmaceutical
Campofrio FoodGroup, S.A.	Services and Branded Products	Branded nondurable
CIN - Corporação Industrial do Norte, S.A.	Capital and Asset-Intensive	Specialty Chemicals
		Building Materials
COLEP Portugal, SA	Capital and Asset-Intensive	Containers and packaging
Dufry AG	Services and Branded Products	Retail
EDA - Eletricidade dos Açores, S.A.	National Industries and Utilities	Electric Utilities
EEM- Empresa de Electricidade da Madeira, S.A.	National Industries and Utilities	Electric Utilities
ENCE Energía y Celulosa S.A.	Capital and Asset-Intensive	Forest products
	National Industries and Utilities	Multi-Utilities
Esporão, S.A.	Services and Branded Products	Branded nondurable
Estoril Sol, SGPS, S.A.	Services and Branded Products	Leisure and sports
Galp Energia, SGPS, S.A.	Pure Commodity	Oil and gas production
		Oil and gas drilling, equipment and service
Grupo Pestana, SGPS, S.A.	Services and Branded Products	Leisure and sports
Hovione Farmaciencia, S.A.	Capital and Asset-Intensive	Pharmaceutical
Impresa, SGPS, S.A.	Services and Branded Products	Media and entertainment
Jerónimo Martins, SGPS, S.A.	Services and Branded Products	Retail
JMR-Gestao de Empresas de Retalho, SGPS, S.A.	Services and Branded Products	Retail
José de Mello Saúde, S.A.	Capital and Asset-Intensive	Health care equipment and services
Luz Saúde, S.A.	Capital and Asset-Intensive	Health care equipment and services

Company	Macro Sector	Industry
Mota Engil, SGPS, S.A.	Services and Branded Products	Engineering and construction
		Environmental services
	National Industries and Utilities	Transportation infrastructure
		Multi-Utilities
NOS, SGPS, S.A.	Services and Branded Products	Telecom and cable
		Media and entertainment
		Media and entertainment
RAR - Sociedade de Controle (Holding), S.A.	Capital and Asset-Intensive	Containers and packaging
		REITs
	Pure Commodity	Agribusiness and commodity foods
	Services and Branded Products	Branded nondurable
Secil - Companhia Geral de Cal e Cimento, S.A.	Capital and Asset-Intensive	Building Materials
Semapa - Sociedade de Investimento e Gestão, SGPS, SA	Capital and Asset-Intensive	Building Materials
	Capital and Asset-Intensive	Forest products
Sonae Capital, SGPS, S.A.	Capital and Asset-Intensive	Capital goods
	National Industries and Utilities	Multi-Utilities
	Services and Branded Products	Leisure and sports
		Leisure and sports
Sonae Investimentos - SGPS, S.A.	Services and Branded Products	Retail
Sonae - SGPS, S.A.	Services and Branded Products	Retail
		Telecom and cable
Sovena Group - SGPS, S.A.	Pure Commodity	Agribusiness and commodity foods
		Oil and gas production
	Services and Branded Products	Branded nondurable
Sovena Oilseeds Portugal S.A.	Pure Commodity	Agribusiness and commodity foods
Sovena Portugal - Consumer Goods, S.A.	Services and Branded Products	Branded nondurable
Sumol + Compal Marcas S.A.	Services and Branded Products	Branded nondurable
The Navigator Company, S.A.	Capital and Asset-Intensive	Forest products

Appendix 7 – *"Scale" Scorecard Proposal*

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Revenue (in € MM)	> 3000	> 1500	> 750	> 500	> 250	> 200	> 150	> 100	> 50	< 50
ROIC	Significantly outperforming industry average	Outperforming industry average	Well above industry average	Above industry average	At industry average	Below industry average	Below industry average, but still above WACC	At par with WACC, value stagnation	Below WACC, value destruction	Significantly below WACC, value destruction

Industry	Average ROIC	Industry	Average ROIC
Aerospace and defense	18,00%	Raw Commodity	8,00%
Agribusiness and commodity foods	12,00%	Media and entertainment	16,00%
Auto OEM	7,00%	Merchant power	8,00%
Auto suppliers	13,00%	Midstream energy	8,00%
Branded nondurable	14,00%	Oil and gas drilling, equipment and service	10,00%
Building materials	5,00%	Oil and gas production	14,00%
Business services	8,00%	Pharmaceutical	26,00%
Capital Goods	13,00%	Package express	10,00%
Commodity chemicals	7,00%	REITs	14,00%
Consumer durables	18,00%	Retail	10,00%
Containers and packaging	10,00%	Specialty chemicals	13,00%
Engineering and construction	14,00%	Technology - hardware and semiconductors	11,00%
Environmental service	8,00%	Technology - software and service	22,00%
Forest and products	11,00%	Telecom and cable	7,00%
Health care equipment and services	15,00%	Transportation	8,00%
Homebuilders	2,00%	Transportation infrastructure	8,00%
Leisure and sports	7,00%	Utilities	6,00%

values by McKinsey study: "Data Focus: A long-term look at ROIC", in McKinsey on Finance, Number 18, Winter 2016.

Appendix 8 – *"Business Profile" Scorecard Proposal*

Industry Risk

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Market Characteristics	Highly reliable and steady demand with well-known history and impervious to economic cycles. Products or services, are absolute necessities for day-to-day living with virtually zero demand elasticity. OR Highly reliable and steady demand; well-known history; impervious to economic cycles and strong entry barriers.	Reliable and steady demand, with well-known history, although moderately exposed to economic cycles. Little elastic demand; very high competitive differentiation and remote possibility of product substitution. The products or services perceived to be nearly essential. OR Reliable and steady demand with well-known history, although moderately exposed to economic cycles and strong entry barriers.	Mostly stable with moderate exposure to business cycles; known history and little elastic demand. Moderate risk of product substitution. The products, or services, perceived to be very important. OR Mostly stable with moderate exposure to business cycles; known history and presence of entry barriers.	Steady demand expected over the medium term; moderate exposure to business cycles and medium-term history. Demand exhibits some signs of elasticity and the risk of product substitution begins to surface. The products, or services, perceived to be very important. OR Steady demand expected over the medium term with moderate exposure to business cycles and limited entry barriers.	Steady demand expected over the short term with significant exposure to business cycles and recent history. Demand exhibits clear signs of elasticity and the risk of product substitution is readily evident. The products, or services, perceived to be somewhat important. OR Unsteady demand expected over the medium term with moderate exposure to business cycles and limited entry barriers.	Known recent expected demand but its stability over the economic cycle is more uncertain. Demand is elastic, characterized by recent or little history and the risk of product substitution is easy. The products, or services, perceived to be of limited important.	Unknown demand path through the business cycles and little or no history. Demand is completely elastic; the products are discretionary or with significantly delayed or eliminated purchases certain under even mild macroeconomic or cyclical factors. The products, or services, are little important for the customer.	Unknown demand trajectory and highly elastic. Products are absolutely discretionary, with elimination of purchases certain under even mild macroeconomic or cyclical factors. The products, or services, are not important for the customer.	---	---

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Expected Growth	Market characterized by very high and sustainable organic growth inside a maturity stage with a higher growth compared to the GDP. The products or services, hardly will be outdated over long term.	Market characterized by predictable organic growth significantly above nominal GDP growth inside a maturity stage. The products or services, hardly will be outdated over medium term.	Predictable organic growth above nominal GDP growth. Moderate risk that the products or services, will be outdated over time. OR Market characterized by predictable organic growth significantly above nominal GDP growth inside an early stage market.	Predictable organic growth near nominal GDP. Moderate risk that the products or services, will be outdated over time.	Predictable organic growth below nominal GDP growth. Moderate risk that the products or services, will be outdated over time.	Negative organic growth rates. High risk that the products or services, will be outdated over time.	High negative organic growth rates and moderate risk of market crisis. High risk that the products or services, will be outdated over medium term.	Many years of negative organic growth rates and evidence of market crisis. High risk that the products or services, will be outdated over short-medium term.	---	---
Exogenous Factors	Evidence of little or no Government and Regulators interferences; access to multiple suppliers and strong negotiation ability. Political or natural events influence are very low. OR Regulation occurs under a fully developed framework that is national in scope, nearly absolute monopoly, and with the possibility to renegotiate the rates over time.	Evidence of little or no Government and Regulators interferences and access to multiple suppliers. The company has some negotiation ability. Political or natural events influence are low. OR Regulation occurs under a fully developed framework that is national in scope, nearly absolute monopoly, and with the possibility to renegotiate the rates in the short-medium term.	Government and Regulators may have some intervention but limited. Access to multiple suppliers with a balanced trade relation between the parties. Possible influence on political or natural events. OR Regulation occurs under a well-developed framework that provide a monopoly position, and with the possibility to renegotiate the rates only under some situations.	Government and Regulators may have some intervention but limited. Access to alternative suppliers which some may have greater negotiation capacity. Evidence of political or natural events influence. OR Regulation occurs under a developed framework that provide a monopoly position, but it may become an open market in the long term. Exists renegotiation but limited.	Government and Regulators may affect the market profitability. Access to alternative suppliers which some may have greater negotiation capacity. Evidence of political or natural events influence. OR Regulation occurs under a developed framework that provide a monopoly position, but it may become an open market in the short-medium term. Exists renegotiation but very limited.	Government and Regulators have active intervention in the market setting prices or margins or through concessions. The company depend on 1 or 2 main suppliers with greater negotiation capacity. Strong evidence of political or natural events influence. OR Regulation occurs under a discrete framework that provide a monopoly position, but could be became an open market. No renegotiation ability.	Government and Regulators have active intervention in the market setting prices or margins or through concessions. The company depend more than 50% on 1 or 2 main suppliers with greater negotiation capacity. Political or natural events influence continuously the market profitability.	Government and Regulators have active intervention in the market setting prices or margins or through concessions. The company depend more than 50% on 1 supplier with greater negotiation capacity. Political or natural events influence continuously the market profitability.	---	---

Company Risk	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Competitive Profile	Technological leadership and dominant position with minimal competition and products or services that are difficult to replicate. OR Clear leader in multiple categories with high product differentiation; multiple recognized brands or strong reputation in the market. Customer loyalty is unwavering. OR Strong competitive advantage which is expected to remain in the long term; excellent dominant position which is expected to remain stable in the long term.	Technological leadership and dominant position with smaller competitors; products or services are difficult to replicate without large-scale investments. OR Clear leader in at least two markets with high product differentiation; some recognized brands or good reputation in the market. Customer loyalty is very high. OR Strong competitive advantage which is expected to remain in the short-medium terms; excellent dominant position which is expected to remain stable in the short-medium terms.	Technological leadership and dominant position only with some competitors; products or services can be replicate with significant investments. OR Clear leader in at least one market with good product differentiation; at least two recognized brands or good reputation in the market. Customer loyalty is high. OR Good competitive advantage which is expected to remain in the long term; good dominant position which is expected to remain stable in the long term.	Technological and operational know-how limits competitive threats; products or services can be replicate with significant investments. OR One of the leaders in at least one market with moderate product differentiation; at least one recognized brands or good reputation in the market. Customer has loyalty, but not exclusively, to brand. OR Good competitive advantage and good dominant position which are expected to remain stable in the short-medium terms.	Limited differentiation based on technological or operational know-how; products or services can be replicate with reasonable investments. OR One of the leaders in at least one market with discrete product differentiation; necessary investments to maintain brand or reputation positioning. Brand has medium level of awareness but the price may be a factor. OR Discrete competitive advantage and discrete dominant position which are expected to remain stable in the medium terms.	No differentiation based on technological or operational know-how; difficulty to keep products or services differentiated. OR Discrete position in the market; low product differentiation; necessary investments to maintain brand or reputation positioning. Brand has low level of awareness and the price is a factor.	Substantial technological or structural disadvantages; difficulty to keep products or services differentiated. OR Weak market positions; low product differentiation; brand or reputation has minimal to no level of awareness and price is a key differentiating factor.	Permanent technological or structural disadvantages; very hard to keep products or services differentiated. OR Weakly positioned in all markets; no competitive product differentiation; no brand or process recognition. Price alone determines consumer purchasing trends.	---	---

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Operating Efficiency	Cost management highly efficient with strong flexibility in capital outlays. The company is perfectly able to reduce significantly the cost when necessary; Lower fixed costs compared the competitors. OR Strong presence of economies of scales or strong competitive advantage in terms of costs of production. Strong flexibility in capital outlays.	Cost management efficient with strong flexibility in capital outlays. The company is able to reduce significantly the cost when necessary; Lower fixed costs compared the smaller competitors. OR Good presence of economies of scales or good competitive advantage in terms of costs of production. Strong flexibility in capital outlays.	Cost management efficient with good flexibility in capital outlays. The company is able to reduce significantly the cost in the most of the cases; Lower fixed costs compared some competitors. OR Discrete presence of economies of scales or discrete competitive advantage in terms of costs of production. Good flexibility in capital outlays.	Cost management efficient with good flexibility in capital outlays. The company is able to reduce significantly the cost in some cases. Fixed costs near to the competitors. OR Low presence of economies of scales and weak competitive advantage in terms of costs of production. Good flexibility in capital outlays.	Discrete cost management efficient with discrete flexibility in capital outlays. The company is able to reduce significantly the cost only in designed cases. Fixed costs near to the competitors.	Low cost management efficient with low flexibility in capital outlays. The company is is not able to reduce significantly the cost in the most of the cases. Higher fixed costs compared the competitors.	Almost no cost management strategy; low flexibility in capital outlays. The company is is not almost able to reduce significantly the cost. Very high fixed costs compared the competitors.	No cost management strategy; very low flexibility in capital outlays. The company is is not able to reduce significantly the cost.	---	---
Business Segment Diversification	Extremely diverse group of business segment with a wide range of services. End-market is well diversified with no costumer concentration. OR Operates at least in 7 or more product segments; no exposure for more than 30% of the revenue only in one segment.	Very well diversified across segments with a wide range of services. End-market is diversified with very limited costumer concentration. OR Operates at least in 5 or more product segments; no exposure for more than 40% of the revenue only in one segment.	Various business segments with a wide range of services in some of them. Diversified final market with low costumer concentration. OR Operates at least in 4 or more product segments; no exposure for more than 45% of the revenue only in one segment.	Several business segments with a wide range of services in at least one of them. Diversified final market with some costumer concentration. OR Operates at least in 3 or more product segments; no exposure for more than 50% of the revenue only in one segment.	Some business segments with a wide range of services in at least one of them. Some diversification in the end-market with moderate costumer concentration. OR Operates at least in 2 or more product segments; no exposure for more than 60% of the revenue only in one segment.	Some business segments but depend mainly on one of them. Low diversification in the end-market with high costumer concentration.	Only one business segments. Very low diversification in the end-market with high customer concentration	Only one business segments with very high customer concentration. Strong lack diversity.	---	---

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	C 2	D 1
Geographic Diversification	Low sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 30% of the revenue in one market; low country risk profile.	Low sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 35% of the revenue in one market; low country risk profile. OR Low sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 30% of the revenue in one market; high country risk profile.	Low sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 45% of the revenue in one market; low country risk profile. OR Low sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 35% of the revenue in one market; high country risk profile.	Moderate sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 55% of the revenue in one market; low country risk profile. OR Low sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 45% of the revenue in one market; high country risk profile.	Moderate high sales concentration; maintain material operations in 2 or more separate market; no exposure for more than 65% of the revenue in one market; low country risk profile. OR Moderate sales concentration; maintain material operations in 3 or more separate market; no exposure for more than 55% of the revenue in one market; high country risk profile.	High sales concentration; maintain material operations in 2 or more separate market; no exposure for more than 75% of the revenue in one market; low country risk profile. OR Moderate high sales concentration; maintain material operations in 2 or more separate market; no exposure for more than 65% of the revenue in one market; high country risk profile.	High sales concentration; maintain material operations in 1 or more separate market; no exposure for more than 80% of the revenue in one market; low country risk profile. OR High sales concentration; maintain material operations in 2 or more separate market; no exposure for more than 75% of the revenue in one market; high country risk profile.	Very high sales concentration; maintain material operations in 1 or more separate market; exposure over 80% of the revenue in one market.	---	---

Appendix 9 – *"Financial Profile" Scorecard Proposal*

	Aaa 10	Aa 9	A 8	Baa 7	Ba 6	B 5	Caa 4	Ca 3	Caa 2	Ca 1
Services and Branded Products Sector										
Debt / EBITDA	< 0,6	< 1,2	< 2,1	< 3	< 4,3	< 6,2	< 8,5	< 10	< 12	≥ 12
EBITDA / Interest Expenses	> 20	> 15	> 10	> 6	> 3	> 2	> 1	> 0	≤ 0	-
CFO / Debt	> 65%	> 45%	> 30%	> 18%	> 12%	> 5%	> 2,5%	> 0	≤ 0	-
RCF / Net Debt	> 78%	> 52%	> 40%	> 25%	> 15%	> 8%	> 5%	> 2.5%	≤ 2.5%	-
EBITDA Margin	> 30%	> 25%	> 20%	> 15%	> 10%	> 7%	> 4%	> 1%	≤ 1%	-
Capital and Asset-Intensive Sector										
Debt / EBITDA	< 0,6	< 1,3	< 2,2	< 3,3	< 4,5	< 6,2	< 8,4	< 10	< 12	≥ 12
EBITDA / Interest Expenses	> 35	> 21,5	> 12,5	> 7	> 3	> 1,5	> 0,7	> 0	≤ 0	-
FCF / Debt	> 35%	> 28%	> 20%	> 14%	> 8%	> 4%	> 0%	> -5%	≤ -5%	-
RCF / Net Debt	> 65%	> 48%	> 35%	> 20%	> 12%	> 6%	> 2.5%	> 0	≤ 0	-
EBITDA Margin	> 45%	> 32%	> 25%	> 18%	> 14%	> 10%	> 7%	> 3%	≤ 3%	-
Pure Commodity Sector										
Debt / EBITDA	< 0,5	< 1,1	< 2	< 3	< 4	< 5,6	< 7,5	< 9	< 11	≥ 11
EBITDA / Interest Expenses	> 30	> 20	> 10	> 7	> 4	> 2.5	> 1	> 0	≤ 0	-
FCF / Debt	> 40%	> 30%	> 24%	> 18%	> 12%	> 7%	> 3%	> 0	≤ 0	-
RCF / Net Debt	> 60%	> 40%	> 30%	> 20%	> 10%	> 5%	> 2%	> 0	≤ 0	-
EBITDA Margin	> 40%	> 28%	> 22%	> 17%	> 12%	> 10%	> 5%	> 2.5%	≤ 2.5%	-

National Industries and Utilities										
Debt / EBITDA	< 2	< 3.5	< 5	< 6.5	< 8	< 9	< 10.5	< 12	< 15	≥ 15
EBITDA / Interest Expenses	> 10	> 7	> 4.5	> 3	> 2	> 1	> 0	> -1	≤ -1	-
FCF / Debt	> 20%	> 15%	> 12%	> 9%	> 5%	> 2%	> 0%	> -5%	≤ -5%	-
RCF / Net Debt	> 40%	> 30%	> 18%	> 10%	> 7%	> 4%	> 1.5%	> 0	≤ 0	-
EBITDA Margin	> 30%	> 26%	> 21%	> 16%	> 10%	> 7%	> 4%	> 1%	≤ 1%	-

Appendix 10 – *"Financial Policy" Scorecard Proposal*

	Aaa 10	**Aa 9**	**A 8**	**Baa 7**	**Ba 6**	**B 5**	**Caa 4**	**Ca 3**	**C 2**	**R 1**
Management Quality	Professional management with solid track record and strong leadership. Well defined governance structure and independent roles. Clear separation between management and shareholders	Professional management with known track record and good leadership. Defined governance structure and independent roles. Clear separation between management and shareholders	Management recognized by the market with known track record (>5 years in the company) and moderate leadership. Defined governance structure and independent roles. Separation between management and shareholders and business with negligible shareholders	Management recognized by the market with good track record (>3 years in the company) and discrete leadership. Defined governance structure and independent roles. Discrete separation between management and shareholders and business with minor shareholders	Management recognized by the market with good track record (>3 years in the company) and limited leadership. Governance and control structure seemingly without problems. Management can be confused with shareholders and business with limited and transparent shareholders	Management relatively indifferent in the market with no track record and very low leadership. Governance and control structure may be unclear. Management confuses itself with shareholders. Business with shareholders may be relevant but transparent and justifiable	An unfavourable view of Management in the market. Unclearness governance structure and control. Management confuses itself with shareholders. Business with unclear justification, regular compliance according to regulatory and accounting regimes.	Unfavourable background and/or little experience of Management. Absence of governance structure and control. No reference of independence between management and majority shareholders. Business with significant and unclear shareholders. Bad compliance of regulatory and accounting regimes.	Negative Management History or unfavourable perception. Absence of governance and independent control. Businesses with significant shareholders and no apparent logical justification. Very bad compliance with regulatory and accounting regimes	Lack of management history and governance information. Business with significant shareholders without logical justification. No compliance with regulatory and accounting regimes.

Capital Structure	Public commitment to the highest long-term credit profiles. Strong ability to detect the best allocation between the different sources of financing. No essentially event risk and very good capacity to manage the risk	Public commitment to strong credit profile over the long term. Very good ability to detect the best allocation between the different sources of financing. Almost no event risk and very good capacity to manage the risk	Public commitment to a solid credit profile over the long term. Good ability to detect the best allocation between the different sources of financing. Low event risk and good capacity to manage the risk	Some risk that debt-funded acquisitions or shareholder distributions could lead to a weaker credit profile. Modest ability to detect the best allocation between the different sources of financing. Modest event risk and good capacity to manage the risk	Some risk that debt-funded acquisitions or shareholder distributions could lead to a troubled credit profile. Modest ability to detect the best allocation between the different sources of financing. Modest event risk which might cause a rating transition due to limited capacity to handle risk	Debt-funded corporate activities impact leverage levels and credit profile. Questionable ability to detect the best allocation between the different sources of financing. Modest event risk which might cause a rating transition due to limited capacity to handle risk	Debt-funded corporate activities affect leverage levels and credit profile. Questionable ability to detect the best allocation between the different sources of financing. Debt-equity mix spurs event risk and limited capacity to react to risk	Overhang of debt in corporate capital structure. Weak ability to detect the best allocation between the different sources of financing. Debt-equity mix severely spurs event risk and limited capacity to react to risk.	Strong overhang of debt in corporate capital structure. Lack of ability to detect the best allocation between the different sources of financing. Debt-equity mix most certainly leads event risk and limited capacity to react to risk.	Excessive amount of debt in corporate capital structure. Lack of ability to detect the best allocation between the different sources of financing. Debt-equity mix will trigger event risk and no capacity to react to risk.
Liquidity & Payout Policy	Expected to have extremely conservative financial policies (including risk and liquidity management); very strong and stable metrics. Very low cash conversion cycle compared the peers	Expected to have very conservative financial policies (including risk and liquidity management); strong and stable metrics. Very low cash conversion cycle compared some peers	Expected to have predictable financial policies (including risk and liquidity management) that preserve creditor interests. Good and stable metrics; low cash conversion cycle compared some peers	Expected to have financial policies (including risk and liquidity management) that balance the interests of creditors and shareholders. Discrete metrics and stability; cash conversion cycle in line with the industry	Expected to have financial policies (including risk and liquidity management) that tend to favour shareholders over creditors. Short-term asset and liability positions that require surveillance; conversion cycle ensures sufficient cash & equivalents to meet financial obligations	Expected to have financial policies (including risk and liquidity management) that favour shareholders' interests in terms of dividends paid-out over creditors' safety. Short-term asset and liability positions that require intense surveillance; conversion cycle ensures sufficient cash & equivalents to meet financial obligations	Expected to have financial policies (including risk and liquidity management) that pay out an immoderate amount as dividends to shareholders. Doubtful readings for certain short-term items (e.g. working capital & accounts receivable); conversion cycle elevated compared to peers	Expected to have financial policies (including risk and liquidity management) that pay out an excessive amount as dividends to shareholders. Very doubtful readings for certain short-term items (e.g. working capital & accounts receivable); conversion cycle challenges supply of sufficient cash & equivalents to meet financial obligations	Expected to have financial policies (including risk and liquidity management) that are compromising the regular course of business. Certain current assets and liabilities can be expected not to convert into cash with high certainty. Cash & equivalents barely sufficient to meet financial obligations.	Expected to have financial policies (including risk and liquidity management) that are compromising the regular course of business. Current liabilities outweigh current assets; current assets cannot be converted into cash. Cash & equivalents insufficient to meet financial obligations.

Appendix 11 – *Conversion Table for Implied Z-Score Ratings*

Z"-Score Conversion Table		
Lower	**Upper**	**S&P Rating**
8,15	>8.15	AAA
7,6	8,15	AA+
7	7,6	AA
6,85	7	A+
6,4	6,85	A
6,25	6,4	BBB+
5,65	6,25	BBB
5,25	5,65	BB+
4,75	5,25	BB
4,5	4,75	B+
3,75	4,5	B
3,2	3,75	CCC+
1,75	3,2	CCC
<1.75	1,75	D

from Altman & Hotchkiss, 2006, figure 12.1

Appendix 12 – *S&P Rating Conversion Table*

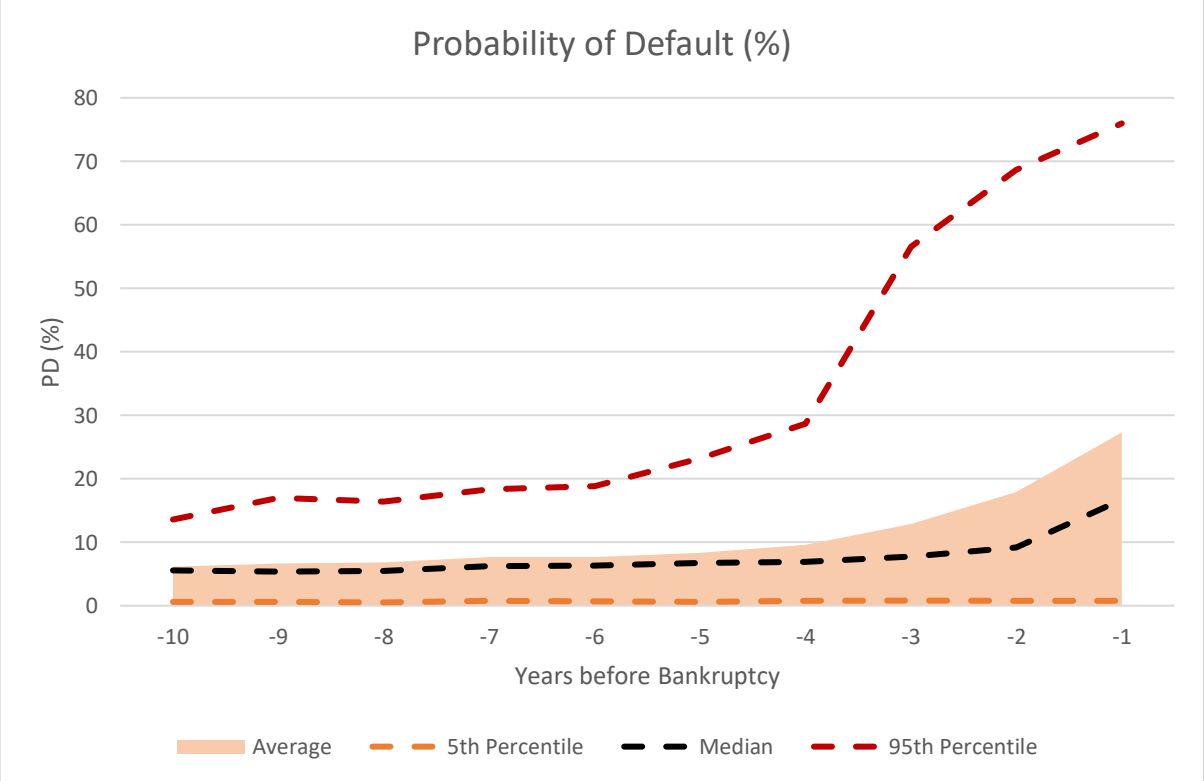
	Conversion Table	
	S&P Rating	**Banco Invest Rating**
Investment Grade	AAA	10
	AA+	9
	AA	9
	A+	8
	A	8
	BBB+	7
	BBB	7
Speculative Grade	BB+	6
	BB	6
	B+	5
	B	5
	CCC+	4
	CCC	4
	D	1

Appendix 13 – *Comparison of Z''-Score, implied and actual Ratings*

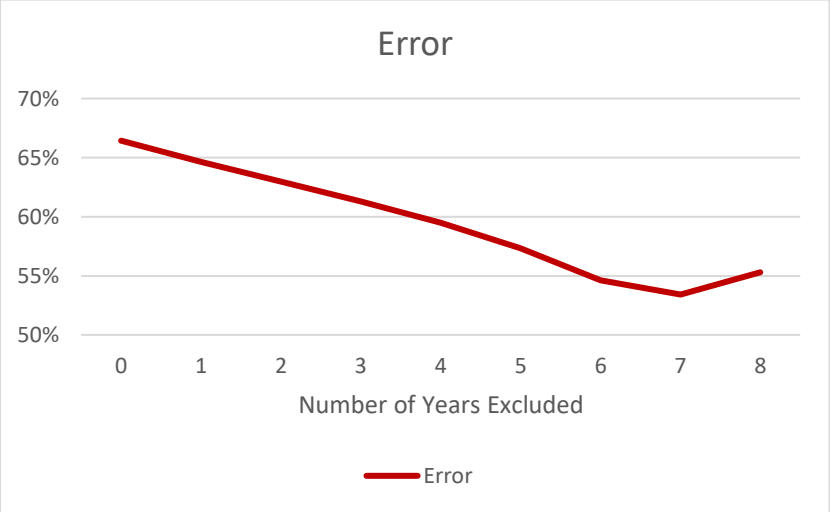
Company	Z"-Score		Z"-Score implied Credit Decision		Z"-Score implied S&P Rating		Z"-Score implied BI Rating		Actual BI Rating	
	Y	Y-1	Y	Y-1	Y	Y-1	Y	Y-1	Y	Y-1
Hovione Farmaciencia, SA	8,65	7,54	Safe Zone (Concede Credit)	Safe Zone (Concede Credit)	AAA	AA	10	9	8	8
Sonae Capital, SGPS, SA	7,33	5,57	Safe Zone (Concede Credit)	Grey Zone	AA	BB+	9	6	7	6
The Navigator Company, SA	7,57	25,47	Safe Zone (Concede Credit)	Safe Zone (Concede Credit)	AA	AAA	9	10	-	8
Esporão, SA	5,64	5,33	Grey Zone	Grey Zone	BB+	BB+	6	6	6	6
Galp Energia, SGPS, SA	6,05	5,93	Safe Zone (Concede Credit)	Safe Zone (Concede Credit)	BBB	BBB	7	7	8	7
Almirall SA	9,79	9,63	Safe Zone (Concede Credit)	Safe Zone (Concede Credit)	AAA	AAA	10	10	8	8
Jerónimo Martins, SGPS, SA	10,89	7,15	Safe Zone (Concede Credit)	Safe Zone (Concede Credit)	AAA	AA	10	9	9	9
Estoril Sol, SGPS, SA	8,00	6,14	Safe Zone (Concede Credit)	Safe Zone (Concede Credit)	AA+	BBB	9	7	-	8
ENCE Energia y Celulosa SA	5,44	5,66	Grey Zone	Grey Zone	BB+	BBB	6	7	8	8
Celulose Beira Industrial (Celbi), SA	4,68	5,20	Grey Zone	Grey Zone	B+	BB	5	6	-	7
COLEP Portugal, SA	5,31	5,12	Grey Zone	Grey Zone	BB+	BB	6	6	7	6
EDA - Eletricidade dos Açores, SA	5,32	4,91	Grey Zone	Grey Zone	BB+	BB	6	6	8	8
Luz Saúde, SA	4,68	4,95	Grey Zone	Grey Zone	B+	BB	5	6	7	7
Altri, SGPS, SA	4,78	5,45	Grey Zone	Grey Zone	BB	BB+	6	6	8	9
Sonae - SGPS, SA	4,96	4,66	Grey Zone	Grey Zone	BB	B+	6	5	8	8
NOS, SGPS, SA	4,63	4,72	Grey Zone	Grey Zone	B+	B+	5	5	7	7
CIN - Corporação industrial do Norte, SA	4,98	5,30	Grey Zone	Grey Zone	BB	BB+	6	6	7	7
Campofrio FoodGroup, SA	5,19	5,85	Grey Zone	Safe Zone (Concede Credit)	BB	BBB	6	7	7	7
Semapa - Sociedade de Investimento e Ges	4,81	5,11	Grey Zone	Grey Zone	BB	BB	6	6	-	7
Sumol + Compal Marcas SA	4,03	4,34	Grey Zone	Grey Zone	B	B	5	5	-	6
RAR - Sociedade de controle (Holding), SA	5,08	4,87	Grey Zone	Grey Zone	BB	BB	6	6	6	6
Grupo Pestana, SGPS, SA	4,51	4,52	Grey Zone	Grey Zone	B+	B+	5	5	7	7
Dufry AG	5,19	4,69	Grey Zone	Grey Zone	BB	B+	6	5	7	6
Impresa, SGPS, SA	4,25	4,43	Grey Zone	Grey Zone	B	B	5	5	5	5
José de Mello Saúde, SA	3,89	3,91	Grey Zone	Grey Zone	B	B	5	5	6	6
Bial Portela, SA	4,21	4,33	Grey Zone	Grey Zone	B	B	5	5	6	5
EEM- Empresa de electricidade da Madeira	4,25	4,35	Grey Zone	Grey Zone	B	B	5	5	6	7
Mota Engil, SGPS, SA	3,97	4,34	Grey Zone	Grey Zone	B	B	5	5	5	5

Appendix 14 – *Type I and Type II estimation errors for PD estimation*

Appendix 15 – *Probability of Default over time*



Appendix 16 – *Probability of Default Type II Estimation Errors, removing recent observations*



Appendix 17 – *Comparison of Probabilities of Default from Logit Regression and Rating Scores*

Company	Probability of Default		Banco Invest Rating	
	Y	Y-1	Y	Y-1
Hovione Farmaciencia, SA	0,22%	0,32%	8	8
Sonae Capital, SGPS, SA	0,66%	2,10%	7	6
The Navigator Company, SA	1,28%	1,22%	-	8
Esporão, SA	1,28%	1,83%	6	6
Galp Energia, SGPS, SA	1,65%	2,34%	8	7
Almirall SA	1,68%	0,95%	8	8
Jerónimo Martins, SGPS, SA	1,81%	2,56%	9	9
Estoril Sol, SGPS, SA	2,02%	3,45%	-	8
ENCE Energía y Celulosa SA	2,49%	1,55%	8	8
Celulose Beira Industrial (Celbi), SA	3,71%	2,78%	-	7
COLEP Portugal, SA	3,24%	4,75%	7	6
EDA - Eletricidade dos Açores, SA	3,27%	4,19%	8	8
Luz Saúde, SA	3,80%	2,96%	7	7
Altri, SGPS, SA	4,17%	2,77%	8	9
Sonae - SGPS, SA	4,29%	4,94%	8	8
NOS, SGPS, SA	4,32%	4,24%	7	7
CIN - Corporação industrial do Norte,	4,48%	4,10%	7	7
Campofrio FoodGroup, SA	4,71%	2,64%	7	7
Semapa - Sociedade de Investimento	4,83%	4,77%	-	7
Sumol + Compal Marcas SA	5,59%	4,66%	-	6
RAR - Sociedade de controle (holding)	5,20%	6,28%	6	6
Grupo Pestana, SGPS, SA	5,19%	5,90%	7	7
Dufry AG	5,38%	6,35%	7	6
Impresa, SGPS, SA	5,47%	4,75%	5	5
Sovena Oilseeds Portugal S.A	5,88%	4,44%	6	7
José de Mello Saúde, SA	7,51%	7,08%	6	6
Bial Portela, SA	6,81%	5,35%	6	5
EEM- Empresa de electricidade da Ma	8,07%	7,84%	6	7
Mota Engil, SGPS, SA	10,04%	8,98%	5	5

IX

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